ARCHIVES OF OTOLARYNGOLOGY

VOLUME 13 MAY, 1931 NUMBER 5

THE PROGNOSTIC VALUE OF EXAMINATION OF THE BLOOD IN OTOLOGY*

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Careful observations of the blood taken at frequent intervals have proved that the blood reflects the physiologic and pathologic processes of the human organism. Clinicians and surgeons are realizing this fact more and more and are utilizing examinations of the blood much more frequently than those who preceded them. The physician of yesterday, depending on the number of leukocytes and the percentage of polymorphonuclear neutrophils for his information in cases of severe infections, often found himself unable to explain apparently contradictory relationships. With the appearance of the work of Arneth and Schilling, this apparently false relationship was clarified and explained. Today, while the actual number of leukocytes is of but casual importance, the number of immature neutrophils or "staff cells" has achieved the center of the stage.

The importance of the staff cell in infections has been proved beyond doubt. Of what value is the careful morphologic examination of the blood to the otologist? Can the blood count be of assistance in the diagnosis, prognosis and treatment of otological conditions? Every otologist is confronted daily with the problem of whether or not operation is necessary. Often the question is not whether an operation is necessary, but when. Will the patient with otitis media purulenta improve, or will mastoidectomy be necessary? The roentgen examination, which often shows congestive changes accompanying an otitic infection, is not conclusive. Nor are the otologist's worries over after his patient has been operated on and a broken down mastoid exenterated. The dural plate may have been found to be diseased and loose, or the sinus plate destroyed, and the wall of the sinus dull and discolored. Then again, the suppuration in the mastoid may have progressed, causing a perisinus abscess or a subdural or petrosal suppuration. Will the exacting exenteration of all of the diseased tissue be followed by an uneventful recovery? These questions arise perpetually in the mind of the busy otologist, and keep him constantly worried. Can the hematologist be of assistance to him in these acute and annoying dilemmas?

* Submitted for publication, Oct. 30, 1930.

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To answer some of these questions, I shall present data yielded by the examination of 240 patients who were under the observation of or operated on by the otolaryngological service of Dr. Samuel J. Kopetsky for a period of one year. Among these there were 88 cases of acute otitis media, some unilateral, others bilateral, 105 of acute mastoiditis, 9 of chronic mastoiditis, 9 of perisinus abscess, 12 of sinus thrombosis, 5 of abscess of the brain and 7 of meningitis. The 7 patients with meningitis and the 5 with abscesses of the brain died. A small number of the representative cases will be reported in résumé form, showing the relationship between these conditions and the hematologic response that they stimulate as visualized by the leukocytic morphology.

TABLE 1.—*Observations on the Blood in Case 1*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Mast Cells	Staff Cells	Segmented Cells	Lymphocytes	Eosinophils	Basophils	Monocytes	Comment
12/ 5	4.06	72	19,000	..	27	62	8	..	..	3	Macrocytosis, increased platelets
6	4.18	73	24,000	2	27	50	17	..	..	4	Toxic degeneration of neutrophils
7	4.16	73	22,400	1	21	55	20	..	..	3	Toxic degeneration of neutrophils
9	4.22	74	28,000	2	34	36	22	..	..	6	Toxic degeneration of neutrophils
10	4.20	74	26,400	4	34	40	17	..	..	5	Toxic degeneration of neutrophils
11	4.15	73	26,300	2	33	37	23	2	..	2	Toxic degeneration of neutrophils, 1 myelocyte
12	4.03	72	23,800	2	32	41	19	..	..	6	Toxic degeneration of neutrophils
13	4.06	73	19,600	2	27	43	25	..	..	3	Toxic degeneration of neutrophils
14	4.16	74	19,000	2	20	39	32	1	..	6	
16	4.06	72	16,300	..	11	49	33	..	1	6	
17	4.41	69	24,300	..	11	71	12	1	..	5	
18	4.17	72	25,600	1	5	77	12	..	..	5	Poikilocytosis
19	3.99	70	22,300	..	5	80	10	..	..	5	
20	3.60	70	18,800	..	4	76	15	..	..	5	
21	3.46	69	13,000	..	5	73	18	1	1	2	
23	3.54	67	12,600	..	5	67	24	..	..	4	
24	3.41	65	12,600	..	5	68	20	1	..	6	

REPORT OF CASES

CASE 1.—E. T., a boy, aged 7½ years, entered the otolaryngological service on December 5, complaining of fever, sore throat and purulent discharge from the left ear. His previous medical history consisted of occasional colds, measles at the age of 2½, whooping cough at 5 and chickenpox and mumps at 3. The surgical history consisted of a tonsillectomy and an adenoidectomy when he was 2½ years old. His present illness commenced six days prior to admission, when a cold and sore throat developed. The following day he vomited, and was found to have fever. Two days prior to admission he complained of pain in the left ear, and his temperature was 103 F. On the day before admission there was a spontaneous appearance of a blood-stained, purulent discharge from that ear.

On admission, the temperature was 104 F. Examination showed: the throat normal, a purulent discharge on the floor of both nostrils; the right ear normal

and a profuse serosanguineous discharge from the left ear, with slight tenderness over the mastoid. A roentgenogram showed congestive mastoiditis, probably due to otitis media. Although the rate of the temperature gradually dropped, the discharge from the ear was profuse, and the patient underwent an operation on December 16, twelve days after admission to the hospital. The observations were: coalescent, broken-down cell walls, débris, granulations and free pus. Retrosinusal cells with pus were removed, the sinus was uncovered, and the knee and tegmen were removed.

Case 2.—M. G., a girl, aged 4, was admitted to the otolaryngological service with the chief complaint of purulent discharge from both ears. Examination showed no sagging or postauricular tenderness. The patient remained in the hospital for observation for a period of sixty days, and was discharged improved.

Comment.—In both of the cases reported the patients had otitis media acuta. The first entered the hospital with marked constitutional symptoms, such as a rise in temperature, malaise and vomiting, the other with only the local complaint of a discharge from the ears. The latter patient showed no constitutional symptoms and a blood count which was normal except for a slight hyperleukocytosis. The first, however, entered the

Table 2.—*Observations on the Blood in Case 2*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Staff Cells	Segmented Cells	Eosinophils	Lymphocytes	Monocytes
5/ 9	4.80	74	12,200	2	25	..	60	13
10	4.12	70	12,800	2	24	1	61	12
12	4.09	70	10,200	4	36	2	48	10
13	3.96	70	13,800	3	32	3	54	8
14	3.87	68	7,000	2	26	..	65	7

hospital with an infection of the upper respiratory tract, marked hyperleukocytosis, inversion of the neutrophil-lymphocyte ratio and a marked increase in the percentage of staff cells. One notices that the number of staff cells started to drop to normal after operation on December 16. The blood picture of this patient before discharge showed slight anemia, leukocytosis and a neutrophil-lymphocyte ratio that was still inverted. With complete healing of the local condition, the blood count will return to normal.

Case 3.—T. G., a boy, aged 6½, admitted to the otolaryngological service on February 10, had had a purulent discharge from the left ear for one week. The patient's tonsils and adenoids had been removed when he was 1½ years old. One week before admission a left aural discharge developed, which was light and watery, but it soon became yellow and thick. Roentgen examination showed suppurative otitis media with destructive changes in the left mastoid. On February 19, operation showed no pus in the mastoid, except a small amount in the antrum, but the entire mastoid was composed of broken-down bone with a few air cells located in the tegmen.

Case 4.—M. H., a man, aged 32, was admitted to the otological service with the chief complaint of a discharge from the left ear for the preceding year. The patient had had trouble with the ear for the past thirty years. He had had occa-

sional attacks of earache and discharge, but for the past year there had been a continuous discharge from the left ear. Five days before admission, a throbbing pain developed in the left ear. Pain and tenderness were also present over the temple and mastoid. Roentgen examination showed productive mastoiditis and destructive changes in the left mastoid due to previous otitic infection. On September 13, a radical mastoidectomy was performed.

TABLE 3.—*Observations on the Blood in Case 3*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Staff Cells	Segmented Cells	Eosinophils	Basophils	Lymphocytes	Monocytes	Comment
2/10	4.18	66	11,800	7	59	1	..	29	4	
11	4.19	68	9,800	7	53	..	1	34	5	
13	4.17	67	13,000	7	57	1	1	30	4	
14	4.19	69	14,200	6	61	..	..	29	4	
15	4.20	67	13,400	6	72	..	..	19	3	
17	4.16	68	11,800	9	54	..	..	32	6	
18	4.10	69	11,000	9	66	..	..	20	5	Platelets increased
19	4.08	68	10,800	7	58	1	1	25	7	1 myelocyte, macrocytosis
20	4.04	67	20,800	7	74	..	..	16	3	Macrocytosis
21	4.00	66	28,800	10	75	..	..	13	2	Slight anisocytosis
22	3.89	66	20,600	7	74	..	..	16	3	Slight macrocytosis
24	4.20	68	10,000	7	61	..	..	27	5	Slight macrocytosis
25	4.16	69	11,600	5	67	..	..	23	5	Slight macrocytosis
26	4.05	68	9,600	5	65	..	..	24	6	Slight macrocytosis
27	3.87	68	11,800	5	65	..	..	22	8	Anisocytosis
28	3.64	67	9,600	4	64	..	..	25	7	Anisocytosis
3/1	3.89	68	11,600	4	68	..	..	21	7	

TABLE 4.—*Observations on the Blood in Case 4*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Staff Cells	Segmented Cells	Eosinophils	Lymphocytes	Monocytes
9/11	4.28	75	13,400	7	75	..	17	1
12	4.58	75	7,600	5	70	..	20	5
13	4.36	75	7,000	6	67	1	24	2
14	4.32	75	8,400	6	68	1	24	1
16	4.15	75	7,800	5	58	1	32	4
17	4.20	75	6,800	4	68	..	24	4
18	4.25	75	8,000	5	60	1	30	4
19	4.14	75	11,000	6	62	1	26	5
20	4.18	75	15,800	4	65	..	27	4
21	4.45	75	11,800	7	63	..	24	6
22	4.46	75	11,000	7	59	..	30	4
23	4.38	75	9,000	4	58	1	32	5
24	4.56	75	8,000	4	65	3	23	5
25	4.28	75	6,800	4	62	2	28	4
26	4.52	75	8,600	3	57	..	34	6
27	4.31	75	8,400	3	64	1	26	6
28	4.21	75	8,000	3	61	..	32	4
29	4.22	75	10,200	3	57	1	34	5
30	4.36	75	11,000	2	60	1	33	4
10/1	4.40	75	8,600	2	61	1	33	3

CASE 5.—L. J., a man, aged 22, was admitted to the otolaryngological service on November 11, complaining of headache, purulent discharge from the ear and postauricular wound. The patient had left the hospital on October 27 after a successful mastoidectomy, feeling well. On November 4, just one week later, he began to complain of frontal headache coming on during the evening and lasting all night. During the day he was symptom-free, except for pains occasionally radiating to the right eye. For the past two days the right ear and the lower end of the mastoid wound had been discharging pus. Examination showed a

purulent discharge from the drain in situ at the lower end of the wound, tenderness on pressure, the canal filled with thick, purulent discharge, a bilateral horizontal and vertical nystagmus and a positive Weber reaction. During the first part of the patient's stay in the hospital all of the symptoms receded, but four days later severe frontal headache and moderate aural discharge and pain in the neck with painful deglutition appeared. A few days later the temperature rose to 102 F., the left pupil became dilated, and paralysis of the soft palate and uvula and a slight facial paralysis of the right side developed. The patient was operated on for recurrent mastoiditis and suppuration of the petrosal tip. The observations at the time of operation were: necrosis of the bony plate over the knee of the sinus closely adherent to the wall of the sinus and a thickening and thrombosis of the sinus. A blood culture showed two colonies of *Streptococcus mucosus.* On November 30, four days after operation, the patient's temperature rose to 104 F. he became irrational, and twitchings, a pronounced facial paralysis, a Babinski

TABLE 5.—*Observations on the Blood in Case 5*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Mast Cells	Staff Cells	Segmented Cells	Eosinophils	Basophils	Lymphocytes	Monocytes	Comment
11/11	4.96	90	10,000	..	7	70	..	..	20	3	
12	5.07	90	7,200	..	9	53	..	..	36	2	
13	5.10	91	9,800	..	10	51	..	..	38	1	
14	4.89	88	11,600	..	9	65	1	..	22	1	
15	4.72	88	8,000	..	8	63	2	..	26	1	
16	4.82	89	13,000	..	10	50	1	1	36	2	
18	4.87	89	11,400	1	12	62	..	..	20	5	
19	5.05	86	13,800	..	10	72	1	..	14	3	
20	4.84	87	12,400	..	15	68	1	..	14	2	
21	4.73	88	15,000	1	15	66	1	..	14	3	
22	4.69	86	13,400	1	14	70	1	..	11	3	
23	4.70	86	12,000	1	10	69	..	..	17	3	
25	4.49	85	12,400	1	18	57	1	1	20	3	
26	4.78	84	12,200	2	15	68	..	..	11	4	
27	4.67	82	23,800	2	19	73	..	..	4	2	
29	4.58	78	34,000	3	32	54	..	..	7	4	Toxic degeneration of neutrophils
30	4.38	76	32,600	..	33	62	..	..	4	1	

sign on the left and exaggerated knee reflexes developed. A spinal tap yielded fluid with streptococci. The patient became comatose and died nineteen days after admission and four days after operation.

Comment.—The second group consisted of three cases, one of simple mastoiditis, another of chronic mastoiditis and the other of recurrent mastoiditis. In the first case of this group, that of simple mastoiditis, the hematologic observations were from slight to moderate leukocytosis, an inversion of the neutrophil-lymphocyte ratio and a slight increase in the percentage of staff cells (from 4 to 10 per cent). The observations in chronic mastoiditis, such as a slight leukocytosis and a very slight increase in staff cells (from 4 to 7 per cent) are insignificant. The last case of this group, that of recurrent mastoiditis, presents one of the most dangerous infections of the ear. One week after discharge from the hospital, where a simple mastoidectomy had been performed, the patient returned with signs of a complication. Examination of the blood

revealed a slight leukocytosis and a moderate increase in staff cells (from 7 to 18 per cent). As the staff count and leukocyte count showed evidence of rising and the patient's clinical condition became aggravated, he was operated on, and a revision was attempted. After this operation the infection spread into the meninges and the systemic circulation, as evidenced by the presence of streptococci in the blood culture and in the spinal fluid. The leukocyte and staff count rose precipitately, and the patient died.

CASE 6.—S. A., a girl, aged 13, entered the otological service on July 12, with a previous history of having had an operation on the right mastoid a few months before. She had been home only a few days when fever developed. The patient entered the hospital with a temperature of 103.5 F. and pain along the course

TABLE 6.—*Observations on the Blood in Case 6*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Mast Cells	Staff Cells	Segmented Cells	Eosinophils	Lymphocytes	Monocytes	Comment
7/12	4.80	60	14,400	..	26	69	..	4	1	
12	4.98	63	6,500	..	17	61	..	20	2	
13	4.72	65	12,700	..	20	58	1	19	2	Jugular ligation, occlusion of lateral sinus
14	4.56	65	10,100	2	34	39	..	19	6	
15	4.44	73	11,000	1	25	57	..	17	..	
16	3.68	60	16,000	1	19	52	..	28	..	Revision of mastoid
18	4.48	73	9,500	1	14	50	..	25	10	
19	4.24	70	8,500	..	4	36	2	57	1	
20	5.04	80	16,000	2	8	60	1	27	2	
22	4.84	78	8,700	..	9	50	..	38	3	
23	5.28	80	7,500	..	7	45	..	44	4	
26	5.84	82	16,000	..	3	41	..	51	5	
28	....	..	.....	..	3	31	1	60	5	
30	4.32	75	9,300	..	6	42	..	46	6	
8/5	4.24	72	8,500	..	1	39	..	59	1	
9	4.08	75	7,000	..	2	34	4	59	1	

of the right jugular vein. A ligation of the jugular vein and occlusion of the lateral sinus was done the next day. Because the high rate of temperature persisted, a revision of the mastoid was deemed advisable and was performed.

CASE 7.—C. A., a boy, aged 8, entered the otological service, with the complaints of pain in the right ear, purulent discharge and a fever. The patient's illness had commenced ten days prior to admission, when, following a cold in the head of one week's duration, he began to complain of pain in the region of the right ear. The pain grew worse and was associated with fever. Paracentesis was performed three days later, and yielded a slight amount of serosanguineous discharge. The patient's condition improved until two days before admission, when the old symptoms recurred. Paracentesis done on the day before admission yielded thick yellow pus. During the patient's stay in the hospital, from November 9 to the date of his death nineteen days later, he had an intermittent septic temperature of from 99.4 to 105.8 F. A roentgenogram taken two days after admission showed no abnormal condition. On November 13, a blood culture showed two colonies of *Streptococcus hemolyticus*. Operation performed on the same day did not show a pathologic process in the mastoid cells; the sinus was exposed and

was found to be plugged at the knee; its wall was whitish gray and necrotic toward the bulb. The sinus was opened, and fluid pus was obtained. A suction tube was introduced into the vein, and the contents were evacuated. The internal jugular vein was exposed and resected. Four transfusions of blood were of no avail. A blood culture one week after operation showed fifteen colonies of *Streptococcus hemolyticus*. The temperature did not recede, and the patient died in a state of coma.

Case 8.—S. J., a man, aged 68, was admitted to the hospital on December 23, complaining of discharge and pain in the left ear and inability to close the left eye.

Table 7.—*Observations on the Blood in Case 7*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Mast Cells	Staff Cells	Segmented Cells	Eosinophils	Basophils	Lymphocytes	Monocytes	Comment
11/9	4.610	75	23,400	2	19	68	..	..	8	3	
12	4.560	62	12,500	3	22	43	..	..	30	2	
13	4.180	62	11,400	1	18	53	..	..	26	2	Poikilocytosis
14	3.890	60	15,000	2	24	44	..	..	27	1	2 myelocytes
15	3.810	60	17,200	1	25	39	..	..	34	1	
18	4.060	61	24,300	1	15	33	..	..	49	2	
19	4.030	64	23,200	1	16	50	..	..	31	2	Toxic degeneration of neutrophils
20	4.160	63	18,600	..	9	41	..	1	47	2	Toxic degeneration of neutrophils
21	4.170	62	12,400	..	9	42	1	1	45	2	Toxic degeneration of neutrophils
22	4.190	61	15,200	1	26	50	..	..	20	3	Toxic degeneration of neutrophils
23	3.890	63	25,800	1	40	27	..	..	30	2	Toxic degeneration of neutrophils
25	3.695	58	19,600	2	47	32	..	..	17	2	Toxic degeneration of neutrophils
26	3.238	47	23,400	3	42	33	..	..	18	4	Toxic degeneration of neutrophils
27	3.250	49	26,200	2	40	36	..	..	19	3	Toxic degeneration of neutrophils
29	3.307	53	22,800	1	40	34	..	..	23	2	Toxic degeneration of neutrophils

Table 8.—*Observations on the Blood in Case 8*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Mast Cells	Staff Cells	Segmented Cells	Lymphocytes	Monocytes	Comment
12/24	4.76	90	10,800	..	6	68	18	8	
26	4.68	87	9,000	..	4	65	29	2	
1/10	4.35	84	22,000	2	12	79	4	3	
11	4.28	85	18,600	3	25	64	5	2	1 myelocyte

Three weeks before admission, he had contracted a cold in the nose. This persisted until nine days before, when he complained of pain in the left ear. After paracentesis was found, the discharge from the ear was profuse, but the pain did not lessen. The patient had also complained of recurring pains in the back of the neck for the past two weeks. Two days before admission he noticed a change in facial appearance and inability to close the left eye. Examination revealed an anterior perforation of the nasal septum, almost complete absence of the left ear drum, purulent discharge from the middle ear under pressure, complete facial paralysis of the left side, partial paralysis of the uvula and tenderness over the left mastoid. Spinal puncture yielded 20 cc. of clear fluid under a pressure of 26 mm. A roentgenogram showed a normal right mastoid and slight diminution in aeration, owing to the presence of otitis media. Although the temperature was

normal, the pain in the left ear and profuse discharge continued until January 8, when mastoidectomy was performed on the left side. After the usual incision, the cortex of the mastoid was laid open, yielding a large amount of pus under pressure. The entire mastoid had coalesced, broken down and filled with granulations of pus and débris. The sinus plate over the knee was necrotic and loose. The dural plate over Trautman's triangle and the tip of the mastoid were necrotic, the process extending into the petrosa and semicircular canals. Two days after operation, there was a rise in temperature to 103.2 F. There was a large amount of pus in the canal and from the angle of the mastoid wound. A blood culture taken after a chill the next day showed *Streptococcus mucosus.* Drainage of the meninges and obliteration of the lateral sinus were performed. The spinal fluid was a cloudy and yellowish green, under 26 mm. of pressure. The patient lapsed into coma and died.

Comment.—In this group of three cases, venous involvement was present; the first patient, who had sinus thrombosis, recovered; the

TABLE 9.—*Observations on the Blood in Case 9*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Mast Cells	Staff Cells	Segmented Cells	Eosinophils	Basophils	Lymphocytes	Monocytes	Comment
11/30	2.79	60	15,800	..	23	55	..	..	22	.	
12/ 2	2.78	51	16,200	..	28	58	..	..	12	2	Marked anisocytosis
3	3.00	49	12,000	1	35	46	..	..	14	4	Marked anisocytosis, increased number of platelets
4	3.01	49	13,300	4	32	47	1	..	12	4	Polychromasia
5	3.25	47	13,600	3	33	40	..	..	21	3	
6	3.47	47	15,300	1	24	50	1	..	20	2	2 myelocytes
7	3.37	47	10,000	1	20	46	1	1	28	3	
16	3.53	47	14,200	2	20	65	..	..	10	3	
24	3.56	50	13,000	..	7	63	2	..	24	4	
28	3.72	53	16,000	..	9	43	2	1	41	4	

second, who had thrombosis of the primary bulb, died, and the third, who had sinus thrombosis and cerebellar abscess, also died. Table 6 shows a marked increase in staff cells, which were somewhat increased after the ligation of the jugular vein, but which became normal after the revision. In table 7, progressive anemia, leukocytosis and a marked increase in neutrophils and staff cells, as high as 47 per cent, are noted. In table 8 is shown a negative blood picture resulting from a dangerous infection with *Streptococcus mucosus.* After the mastoidectomy had been performed, the leukocytes and staff cells showed a marked increase.

CASE 9.—H. G., a boy, aged 13, entered the otological service on November 30, complaining of earache, fever and hematuria. Ten weeks before admission, after swimming, pain and discharge from the right ear developed. Four weeks later a mastoidectomy was performed. After a stay of four weeks in the hospital, he was discharged. Shortly after this, high temperature and bloody urine suddenly developed. The discharge from the ear also continued. Urinalysis showed: specific gravity, 1.010; a trace of albumin; occasional granular casts; many red and few white cells, and phenolsulphonphthalein, 85 per cent.

CASE 10.—H. S., a woman, aged 60, was admitted to the hospital on March 16, with the complaint of pain and purulent discharge from the right ear. Three weeks before admission, a discharge had begun from the right ear without pain or fever. Six days before admission, pain in the ear and the region of the mastoid and a temperature of 100.2 F. developed. A roentgenogram showed acute mastoiditis on the right side. The chemical analysis of the blood showed: sugar, 170, 180, 150, 200 and 300 mg. Urinalysis revealed: specific gravity, 1.048; albumin, +; sugar, 1.7 per cent; acetone, +; a few hyaline casts and occasional red cells.

Comment.—The last group of cases shows complications not in the region of the mastoid. The case illustrated in table 9 shows marked anemia, leukocytosis and a marked increase in staff cells in spite of a clean mastoid wound, although there was a complicating condition of glomerular nephritis. Table 10 shows a normal blood picture in a patient with mastoiditis, myocarditis and diabetes. After operation, facial erysipelas, fever, leukocytosis and an extremely high percentage of staff cells developed and the patient died.

TABLE 10.—*Observations on the Blood in Case 10*

Date	Red Blood Cells	Hemoglobin	White Blood Cells	Mast Cells	Staff Cells	Segmented Cells	Eosinophils	Lymphocytes	Monocytes	Comment
3/16	4.00	75	8,800	..	6	69	1	24	..	
17	4.06	70	13,200	..	11	79	..	9	1	
19	4.16	70	22,000	..	8	82	..	10	..	
20	4.05	70	29,000	..	6	82	..	12	..	
21	3.90	70	20,600	..	41	49	..	9	..	1 myelocyte
22	4.51	75	18,600	2	48	34	..	15	..	1 plasma cell

COMMENT

After a series of blood counts had been done in an assorted group of otological cases, it soon became evident that, owing to the marked divergence of the hematologic observations, an examination of the blood could not be of assistance in diagnosis. It was often most surprising to find the response of the bone marrow more active in a patient with acute otitis media than in one with acute mastoiditis. It was found also that the height of the staff count could not be used as an indicator for operation in cases of acute otitis, as it often happened that a patient having an infection of the middle ear with a normal staff count needed operation, while one with a staff count of from 18 to 35 per cent might improve without surgical intervention. In cases of mastoiditis with venous complications, the response of the staff cells was much higher than in cases complicated by meningitis or petrositis. Patients in whom complications developed in regions outside the skull always showed marked reactions. Although the morphologic study was useless in diagnosis, it was a definite aid in prognosis. Any patient who showed an increase in staff cells

after mastoidectomy invariably had some complication, and did not improve until the immature cell count receded to its normal level.

The questions now arise: How can one explain some of these apparent inconsistencies? Why should a case of acute otitis media purulenta, which usually precedes the infection of the mastoid, give a more active response than the latter? Why is there no consistency in the reactions called forth by each of the various types of disease? To explain these differences one must realize that the appearance of the staff cells in the circulation is the response of the bone marrow to an irritation that is not specific. The greater the irritating influence, the greater is the demand for leukocytes, and the greater will be the appearance of immature cells. It would seem that infections of the middle ear and the sinus more often result in a severe systemic involvement, whereas the infection of the mastoid, usually only a localizing or pointing of the otitic inflammation, causes few if any systemic symptoms and either gives normal figures in the examination of the blood or shows evidence of slight stimulation. The toxin elaborated in most cases of mastoiditis in children seems to call forth a marked increase in the leukocyte count in the form of mature neutrophils causing an inversion of the neutrophil-lymphocyte ratio. In these cases the bone marrow under mild stimulation is able to increase its normal production so that immature cells do not increase. In cases in which the mastoid process is rapidly destroyed while the infection of the upper respiratory tract and otitis media are progressing, the response of the staff cells will be high. Meningitis and abscess of the brain following mastoidectomy without invasion of the blood stream usually cause but a mild increase in the staff cells.

SUMMARY

As a result of thousands of examinations of the blood in a series of 240 patients in the otological service, including 108 with acute mastoiditis, 9 with chronic mastoiditis, 9 with perisinus abscesses, 12 with sinus thrombosis, 5 with abscess of the brain, 7 with meningitis and 88 with otitis media purulenta acuta, I have found:

1. Any rise in the percentage of staff cells indicates the presence of some postoperative complication.

2. These complications need not be in the postoperative area, but may involve some other portion of the body.

3. The leukocyte and staff counts are often much higher in acute otitis media purulenta than in acute mastoiditis.

4. The height of the staff count in acute infections of the middle ear is not a guide to the necessity for operation. Patients with high staff

cell counts often improve and do not require operation, while others with low counts require mastoidectomy.

5. The blood pictures in the acute, chronic or recurrent cases of mastoiditis do not show any difference and rarely show an increase in cells unless some complication is present.

6. Cases of abscess of the brain or meningitis do not cause a marked increase in the reaction of the bone marrow unless accompanied by systemic involvement.

7. All cases of mastoiditis with venous complications show marked changes in the blood picture.

8. Although the blood count cannot be utilized as an aid in diagnosis, when used in a series, it is of inestimable importance in prognosis.

TUMORS OF THE LARYNX AND THYROID

A ROENTGENOGRAPHIC STUDY *

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In 1903 and later in 1911, Scheier [1] employed x-rays to demonstrate the various positions assumed by the tongue, soft palate, epiglottis and larynx during phonation. He also studied the behavior of the larynx during deglutition of a bismuth mass. The first systematic attempt to study the larynx by means of x-rays was made by Thost [2] in 1913, when he used this method of exhibiting the well developed muscular apparatus in the larynx of professional singers.

The pharynx, larynx and trachea represent a funnel-shaped, air-filled hollow cylinder embedded in organs of greater density. A lateral roentgenographic view of these viscera shows a characteristic shape of the lumen, which is fairly uniform for the male and for the female. Deviations in the contour of this lumen, brought about by extrinsic pressure or by the intrinsic presence of inflammatory or neoplastic tumors, can be recognized and diagnosed by lateral roentgenography. We have studied the changes produced in the structure and appearance of these organs in eighty cases of laryngeal, pharyngeal and thyroid tumors.

PRINCIPLES OF TECHNIC

The overlying shadows of the cervical vertebrae obscure the antero-posterior views of the neck; in fact, sagittal examination is helpful only in revealing lateral displacements of the trachea. Lateral roentgenograms are preferable, as they display the pharynx and larynx to the best advantage; displacements of the trachea in a dorso-anterior direction or any flattening of the trachea in this direction are readily detected by this method. We have employed, therefore, only lateral views of

* Submitted for publication, Nov. 25, 1930.

* From the Memorial Hospital.

1. Scheier, M.: Arch. f. Laryngol. u. Rhinol., 1903, vol. 15; Zur Physiologie des Schluckakts, Schäfer-Passow Beitr., 1911, vol. 55, nos. 1 and 2.

2. Thost, A.: Archiv und Atlas des normalen und kranken Kehlkopfs des Lebenden im Röntgenbild, Fortschr. a. d. Geb. d. Röntgenstrahlen, 1913, vol. 31.

the neck. In some cases, we have taken stereoscopic views for more accurate localization.

There are three possible postures that the patient may assume. In the recumbent posture, he lies on the left side with the left arm posteriorly and both shoulders depressed. The head rests on sandbags to permit the neck to lie in a horizontal plane. The casette is placed beneath the neck and the tube is directly overhead. In the dorsal decubitus posture the subject rests flat on his back with a support beneath the shoulders in order to extend the neck as in opisthotonus. The tube is placed lateral to the table, and the beam of rays passes in a horizontal direction to impinge on a casette held upright against the distal side of the neck.

In the erect posture, the patient sits on a stool with his left shoulder abutting against an upright stereoscopic chest shift containing the casette. He grasps the seat of the chair in order to depress the shoulders as far as possible. A photographer's head clamp is useful for the maintenance of immobility of the head. The neck is hyperextended and the film is centered toward the posterior part of the thyroid cartilage. Pfahler [3] modified this technic somewhat by the following procedure: Both shoulders are in contact with the plate to have the chest in an anteroposterior position while the head is turned to the side; a roentgenogram made in this way includes, therefore, a lateral view of the neck, an anteroposterior view of the chest and an exhibition of the trachea throughout its length.

The bodily habitus of the subject influences the amount of trachea visible on the roentgenogram; in the hypersthenic person with a short, thick neck it is particularly difficult to obtain tracheal pictures. To eliminate the blurring of the image, the subject should hold his breath, but should not precede this maneuver by a deep inspiration. Hickey [4] advised the use of flash exposures to prevent the blurring that occasionally follows cardiac impacts transmitted by the carotid arteries.

With the casette removed the distance of the shoulder to the neck, there is the possibility of magnification. This can be avoided by the use of the Eppendorf casette in which the lower edge is concave to fit snugly over the shoulder in close approximation to the lateral aspect of the neck; or the Victor casette, 5 by 7 inches (12.7 by 17.7 cm.) in size, with a narrow rim, such as is used for duodenal roentgenograms, may be employed; the patient holds this casette in position against his neck. Duplitized films in double intensifying screens are employed.

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3. Pfahler, G. E.: New Roentgenographic Technique for the Study of the Thyroid, Am. J. Roentgenol. **8**:81, 1921.

4. Hickey, P. M.: Radiography of Normal Larynx, Radiology **11**:409, 1928.

The five following set-ups are presented, each of which has proved suitable for roentgenography of the larynx and trachea:

(*a*) Hickey's technic: a 32 inch focal distance; 50 kilovolts; a high milliamperage; a flash exposure of one-twentieth of a second;

(*b*) Coutard's technic: 70 cm. focal distance; from 70 to 75 kilovolts; from 35 to 40 ma.; length of exposure, one third of a second;

(*c*) Brown and Reineke's technic: target distance, 3½ feet; voltage not to exceed a 5 inch spark gap; 20 ma.; time of exposure from one-half to 1 second, depending on the size of the person;

(*d*) Herendeen's technic: focal distance, 42 inches; 72 kilovolts; 20 ma.; time, from one half to three fourths of a second;

(*e*) Hay's technic: focal distance, 48 inches; voltage not to exceed a 6 inch spark gap; 100 ma.; time exposure, three twentieths of a second.

THE NORMAL PHARYNX, LARYNX AND TRACHEA

The lumen of the pharynx, larynx and trachea has been said to resemble a pistol; the pharynx represents the handle, the larynx the firing mechanism and the trachea the barrel. The anteroposterior diameter of the pharyngeal cavity decreases in size downward to represent a funnel-shaped cavity. Where the pharynx joins the esophagus is a distinct line which is visible at a point opposite the fifth and sixth cervical vertebrae. Under normal conditions the esophagus is collapsed and airless, and is therefore relatively opaque to the x-rays. During quiet respiration or when the breath is held, the opening of the glottis can be distinctly visualized in the lateral roentgenogram. With the technic described, the trachea may be seen as far as the level of the last cervical or first thoracic vertebra. The trachea does not have a lumen of uniform contour, but is slightly constricted in its midportion to resemble an hour-glass. The cartilaginous rings of the trachea are plainly visible where they give a serrated appearance to the anterior wall.

The uvula is often seen as a finger-like structure pendant from the roof of the pharynx and visible above the angle of the jaw. The convexity of the posterior dorsum of the tongue is clearly visible where it terminates in the epiglottic valleculae. Posterior to these valleculae, also known as the glosso-epiglottic fossae, is the epiglottis, the lateral contour of which is distinct against the pharynx. The epiglottis is distinctly concave anteriorly. It lies opposite the third cervical vertebra and appears to project between the wings of the hyoid bone. The posterior wall of the pharynx is represented by an even, uninterrupted line running parallel to the anterior surface of the spinal column. The pyriform sinus is practically never seen in the female and only rarely

in the male. Anterior to the pharynx and below the mandible can be seen the hyoid bone. In elderly subjects the stylohyoid ligament is ossified. The vestibule of the larynx, which is much larger in the male, can be seen as an irregular triangular air space anterior to the pharyngeal cavity.

In young subjects the arytenoid cartilages are recognized as small triangular shadows along the posterior wall of the larynx, but in later life they are obscured by the deposition of lime in this area. These cartilages are so irregular in size and shape that tumors of this situation

Fig. 1.—Normal larynx and trachea of a middle-aged woman. *A*, base of tongue; *B*, vallecula; *C*, epiglottis; *D*, hyoid bone; *E*, arytenoid cartilage; *F*, calcified cricoid cartilage; *G*, trachea; *H*, sternocleidomastoid muscle.

are not well represented on the roentgenogram. The ventricular folds appear as cleancut homogeneous structures situated horizontally in the anterior portion of the cavity. The ventricles of Morgagni are outlined as oval clear spaces in the anterior segments of the thyroid cartilage; they are visible in at least 50 per cent of female patients, but are seldom seen in men older than 40. When these ventricles are visible on the roentgenogram the vocal cords are recognized as forming their upper borders. This is important in the recognition of small intrinsic laryngeal tumors. The conus elasticus between the thyroid and cricoid cartilages protrudes slightly anteriorly in both sexes.

The thyroid cartilage is more developed in males after puberty. In the adult male larynx the principal deposit of lime is in the thyroid cartilage, and the minimal deposit in the cricoid cartilage. In the adult female larynx, on the contrary, the principal deposit of lime is in the cricoid cartilage, and the minimal deposit in the thyroid cartilage. Fraenkel [5] described the ossification of the larynx as follows:

> Ossification of the larynx begins during the eighteenth or nineteenth year of life and in both sexes is first noted in the lower part of the posterior border of the thyroid cartilage. From this region it gradually ascends along the posterior

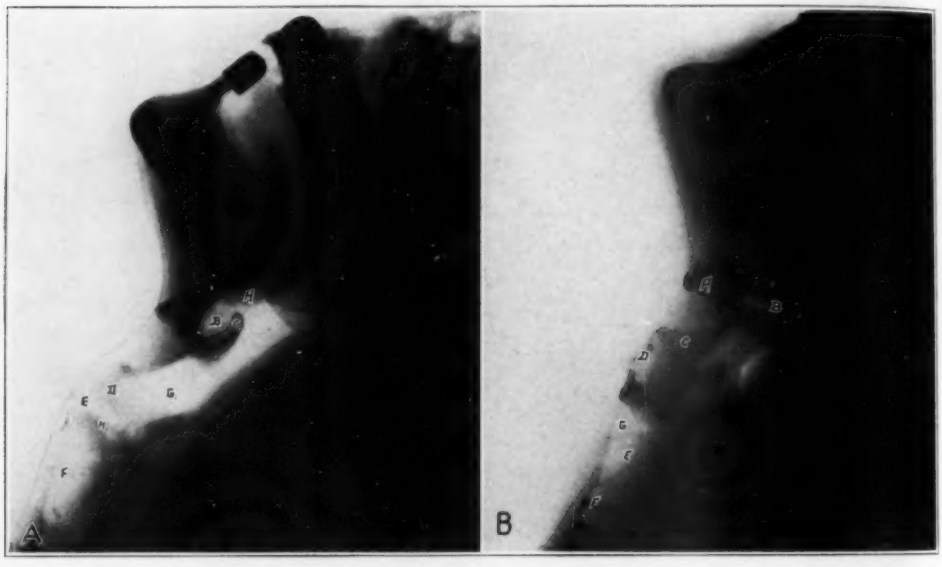

Fig. 2.—*A*, (L. S., a man, aged 52; diagnosis, intrinsic carcinoma of the larynx) a flat, superficial lesion is present on the left vocal cord, extending from the anterior commissure of the arytenoid. The carcinoma is so small and superficial that it does not obscure the ventricle of Morgagni. The roentgenogram confirms the clinical opinion as to the extent and prognosis of this disease. A, base of the tongue; B, vallecula; C, epiglottis; D, thyroid cartilage; E, ventricle of Morgagni; F, trachea; G, laryngeal vestibule, and H, vocal cords. *B*, (C. H., a man, aged 38; diagnosis, intrinsic carcinoma of the larynx) the tumor is small and situated on the right cord posteriorly. The posterior half of the laryngeal ventricle is obscured. A, hyoid bone; B, epiglottis; C, thyroid cartilage; D, anterior half of the laryngeal ventricle; E, subglottic region; F, tracheal rings, and G, conus elasticus.

> border. Ossification then gradually extends forward along the inferior border of the thyroid cartilage, giving rise to an L-shaped mass of bone. In the male a

5. Fraenkel, E.: Fortschr. a. d. Geb. d. Röntgenstrahlen **12**:152, 1908.

new center arises at the inferior thyroid notch and another along the superior thyroid border and by the gradual coalescence of these centers, the cartilage may be eventually surrounded by a bony frame.

Weingaertner demonstrated that the thyroid cartilage begins to ossify in the male in three distinct nuclei or centers; the density of these centers of ossification is greater than the opacity produced by tumors of this location. Furthermore, the tumors are usually single,

Fig. 3 (S. B., a man, aged 68; diagnosis, intrinsic carcinoma of the larynx).—A tumor situated on the right vocal cord extends well below this level, to encroach on the air space. The ventricle of Morgagni is obliterated by the tumor. *A*, epiglottis; *B*, hyoid bone; *C*, thyroid cartilage; *D*, situation of the laryngeal ventricle, *E*, sternocleidomastoid muscle.

which serves as another point in the differential diagnosis. In the female after the age of 20 there is never a conspicuous deposition of lime in the thyroid cartilages; the lime deposits occur chiefly along the posterior border of the cricoid cartilage. Hickey described a definite center of ossification in this locality wherein the deposits are laid down in a regular fashion with a definite center and a less distinct peripheral

shadow. The older the subject the greater the ossification of the larynx; this ossification is more uniform in males and slightly more mottled in females. Up to the age of 25, the ossification of the cartilages is about the same in both sexes, but at a later age the differences are so great that a mere glance at the plate will easily reveal the sex. Iglauer [6] was the first to recognize the oblique bony line which divides the thyroid into two islands in the male, and which is practically always absent in the female. In the cricoid cartilage the deposit of lime always begins in the seal portion and extends forward into the ring portion

Fig. 4 (W. T., a man, aged 34; diagnosis, squamous carcinoma of the larynx). —This carcinoma infiltrates and disrupts the thyroid cartilage to protrude anteriorly as a bulging tumor mass, about to perforate spontaneously. A concurrent infection has occurred, progressing to suppuration. The extensive destruction of the cartilage is visible, but is rendered somewhat hazy by the presence of pus. *A*, oral pharynx; *B*, epiglottis; *C*, hyoid bone; *D*, destruction of thyroid cartilage, and *E*, trachea.

of the cartilage. Calcification precedes the ossification. This difference in the larynx of males and females has been observed in hermaphroditic and eunuchoid types; Siebermann [7] cited the case of a man, aged 28, with endocrine dysfunction and lack of sexual develop-

6. Iglauer, S.: Value of Roentgenography in Diagnosis of Diseases of Larynx and Trachea, J. A. M. A. **63**:1827 (Nov. 21) 1914.

7. Siebermann, H.: Kehlkopfkrebs im Röntgenbild, Fortschr. a. d. Geb. d. Röntgenstrahlen **36**:25, 1927.

ment, whose larynx had the roentgenographic appearance of a girl of 10 or 12 years. Later in life the lower third of the epiglottis may contain deposits of lime which may undergo ossification. The tracheal rings are the last cartilaginous structures of this region to exhibit roentgenographic evidence of calcification.

We have described the normal roentgenographic appearance of the pharynx, larynx and trachea in detail, because a knowledge of the normal condition at various ages in both sexes is necessary in the interpretation of roentgenograms of the various tumors of this region.

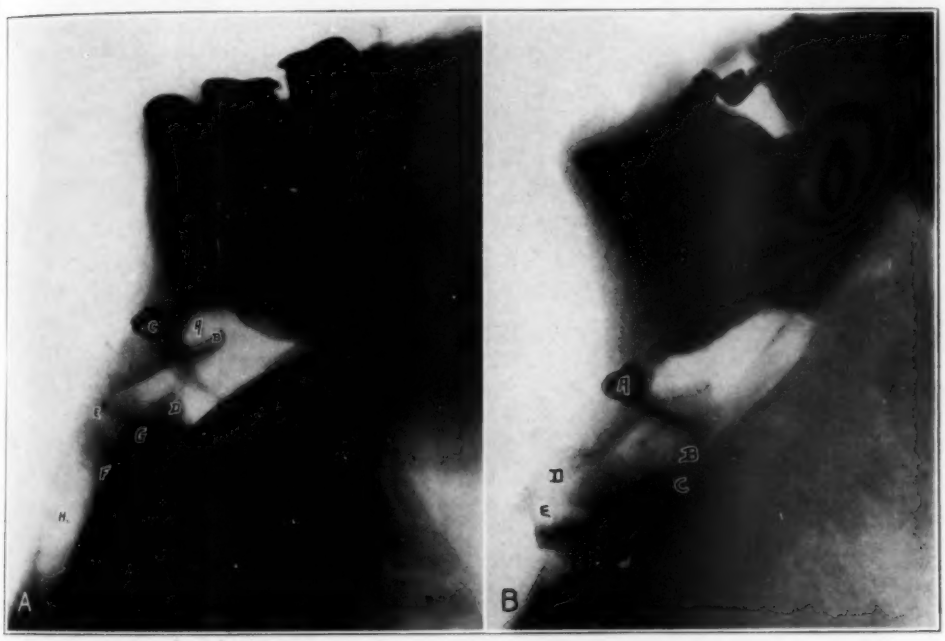

Fig. 5.—*A*, (M. O., a woman, aged 68; diagnosis, extrinsic carcinoma of the larynx) the growth is situated posteriorly and can be seen in the region of the arytenoids. It does not distort the outline of the laryngeal ventricles. There is slight invasion of cartilage with some calcified deposit. Ossification of the cricoid cartilage is moderately advanced. The opaque gold radon seeds are visible. A, vallecula; B, epiglottis; C, hyoid bone; D, aryepiglottic fold; E, ventricle of Morgagni; F, cricoid cartilage; G, extrinsic laryngeal carcinoma containing gold radon seeds in the region of the arytenoid, cuneiform and corniculate cartilages, and H, trachea. *B*, (S. M., a man, aged 57; diagnosis extrinsic carcinoma of the larynx), on the right arytenoid extending one third of the way up the right aryepiglottic fold is an ulcerated lesion, 1.5 cm. in diameter. There are large adenopathies of the cervical lymph glands. Histologically, the tumor is a transitional cell carcinoma. A, hyoid bone; B, aryepiglottic fold; C, gold radon seeds in tumor; D, thyroid cartilage, and E, ventricle of Morgagni showing no involvement of the vocal cords.

TUMORS OF THE LARYNX

The benign tumors of the larynx and hypopharynx are characterized roentgenographically by their homogeneous appearance, clearcut spherical outlines and absence of infiltration. One of the most interesting benign tumors of this organ is the chondroma, of which we observed two recent cases. On the roentgenogram these chondromas appear as multilocular cystic tumors originating usually from the thyroid cartilage and occasionally from the hyoid bone.

In elderly subjects in whom the calcified thyroid cartilage covers the vocal cords like a shield, benign and malignant neoplasms may be

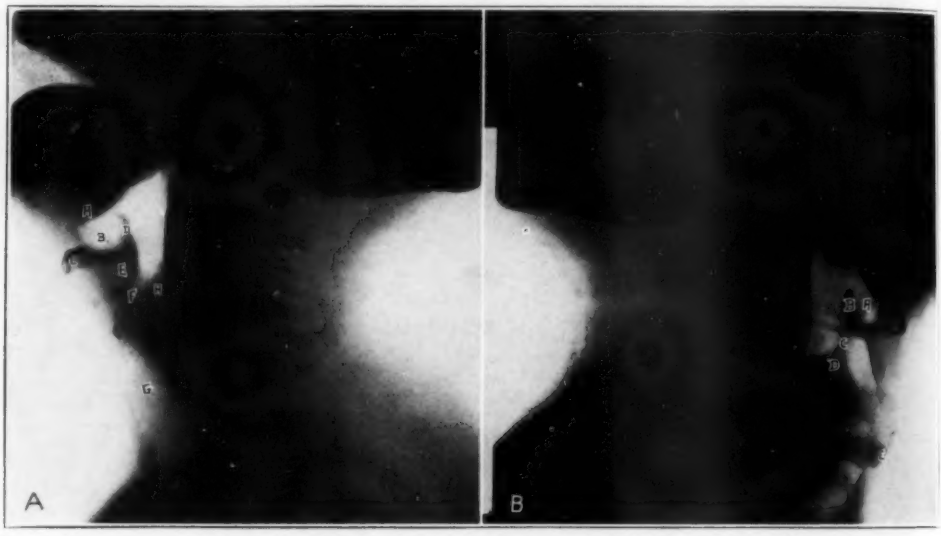

Fig. 6.—*A*, (A. E., a woman, aged 60; diagnosis, extrinsic carcinoma of the larynx) on the posterior surface of the epiglottis is a raised, granular tumor involving the anterior commissure, the right plate of the thyroid cartilage and the right arytenoid cartilage to obstruct the larynx. A, base of the tongue; B, vallecula; C, hyoid bone; D, tip of the epiglottis; E, carcinoma involving the base of the epiglottis; F, disruption of the thyroid cartilage by carcinoma; G, trachea, and H, pyriform sinus. *B*, (J. M., a man, aged 62; diagnosis, extrinsic squamous cell carcinoma of the larynx), an indurated, ulcerated tumor mass occupies the right arytenoid and pyriform sinus. A, vallecula; B, epiglottis; C, thickened aryepiglottic fold; D, extrinsic laryngeal carcinoma, and E, center of ossification in thyroid cartilage.

present on the vocal cords and can be seen only with considerable difficulty by roentgen examination. The air-containing ventricles of Morgagni, which are sharply marked off from the vocal cords, show up as light oval areas on the plate, which correspond to the air of the sinus; these ventricles are defined by the free borders of the true

Fig. 7 (E. L. O., a man, aged 32; diagnosis, extrinsic carcinoma of the larynx).—This extensive carcinoma involves the right vocal cord, the right arytenoid, the right side of the epiglottis, the right vallecula and the base of the tongue. *A*, base of the tongue; *B*, carcinoma in the valleculae; *C*, epiglottis; *D*, upward extension of the tumor process; *E*, thyroid cartilage showing obliteration of laryngeal ventricles, and *F*, trachea.

Fig. 8 (W. L., a man, aged 51; diagnosis, squamous cell carcinoma of the epiglottis).—The epiglottis is completely replaced by a bulky tumor measuring 3 by 3.5 cm. The tumor has extended into the hypopharynx to cause marked dysphagia. *A*, base of the tongue; *B*, hyoid bone; *C*, epiglottic tumor; *D*, extension of the tumor into the hypopharynx, and *E*, hypopharyngeal obstruction.

vocal cords. As soon as a tumor mass of considerable size is present on the vocal cords the roentgenogram will show an irregular line instead of the usual sharp demarcation. This visible irregularity in the margin of the ventricles is proportionate to the size of the tumor. The ventricles of Morgagni may entirely disappear from the plate if the tumor masses fill the sinuses and exclude the air. Although the ossified larynx of aged persons tends to obscure the intralaryngeal tumors, neoplasms of the epiglottis and aryepiglottic fold are easily visualized

Fig. 9 (M. P., an Italian, aged 54; diagnosis, retropharyngeal tumor; microscopic diagnosis, neurogenic sarcoma).—The tumor is posterior to the oral pharynx and anterior to the cervical vertebrae. It protrudes anteriorly into the pharynx and hypopharynx to obstruct completely the esophagus and larynx. These stenoses have necessitated a tracheotomy and gastrostomy. The cervical vertebrae are normal. The patient is now alive, four years after the onset of the disease. The lateral view shows well the occlusion of the hypopharynx. *A*, anterior margin of the tumor; *B*, oral pharynx; *C*, hyoid bone; *D*, occlusion of the hypopharynx; *E*, thyroid cartilage; *F*, ventricle of Morgagni; *G*, trachea, and *H*, tracheal cannula.

in the lateral roentgenogram. Indeed, extrinsic laryngeal carcinomas afford better material for roentgen study in older persons than do laryngeal carcinomas of intrinsic origin. As a rule, carcinomas of the larynx are not demonstrable in the roentgenogram unless they measure

more than 1 cm. in diameter. When the carcinoma infiltrates and distorts the larynx, the extent of the disease is more readily determined by roentgen examination than by indirect laryngoscopy. The peculiar punched-out appearance of the thyroid cartilage as seen in the roentgenograms is almost specific for laryngeal cancer; the sievelike appearance is probably due to invasion of the cartilage by the carcinoma.

Schottelius' description of the invasion of cartilage by carcinoma is applicable to infiltrating laryngeal cancer. The carcinoma may grow

Fig. 10 (F. K., a woman, aged 24; diagnosis, an atypical epidermoid carcinoma, involving the base of the tongue and the valleculae).—On the left side of the base of the tongue is a raised, indurated ulcerated tumor 2.5 cm. in diameter, extending down to the epiglottis and onto the left pyriform sinus. *A*, lingual carcinoma; *B*, hyoid bone; *C*, pharyngeal stenosis; *D*, retroverted epiglottis, and *E*, calcified deposit in the cricoid cartilage.

in solid sheets around the cartilage, which may be found unchanged but completely enveloped by the tumor. This is the picture usually observed when the tracheal rings have been surrounded by carcinomatous tissue. Some of the cartilage in the larynx is rich in marrow and blood vessels; the carcinoma grows directly into the marrow-containing spaces, and later disrupts the cartilage from within, causing necrosis and ulceration. The ossified cartilage and later the cartilage

Fig. 11 (A. A., a man, aged 52; diagnosis, chondroma of the hyoid bone and thyroid cartilage).—On the right side of the thyroid cartilage, extending upward and posterior to the angle of the jaw, is a hard, elongated mass, the midposterior portion of which is fixed to the thyroid cartilage. The tumor measures 9 by 4 by 4 cm. Dr. Herendeen's roentgenographic diagnosis was chondroma, which was subsequently verified in the pathologic laboratory. The tumor is lobulated and contains many small cysts. *A*, hyoid bone; *B*, multilocular tumor; *C*, thyroid cartilage; *D*, ventricle of Morgagni, and *E*, trachea.

Fig. 12 (A. B., a man, aged 40; diagnosis, tuberculosis of the larynx).—The epiglottis has been doubled backward on itself and is partially destroyed. The ulceration extends from the tip of the epiglottis to involve the entire left wall of the larynx including the aryepiglottic fold. The vocal cords are reddened, thickened and edematous. Note the thickened arytenoids and aryepiglottic fold. *A*, base of the tongue; *B*, epiglottis; *C*, aryepiglottic fold, and *D*, thyroid cartilage.

proper are changed. First the matrix and then the cells are destroyed. At the same time, two antagonistic processes are occurring simultaneously: There is an attempted physiologic regeneration of the cartilage by invasion of the carcinoma. When the calcium is being released and reabsorbed at the same time in the larynx, it is deposited in different places in the cartilage to produce a picture characteristic of advanced laryngeal carcinoma. In these pictures the larynx has a granulated appearance, the dark spots rich in calcium showing in contrast with the light areas poor in calcium. This roentgenographic picture is said

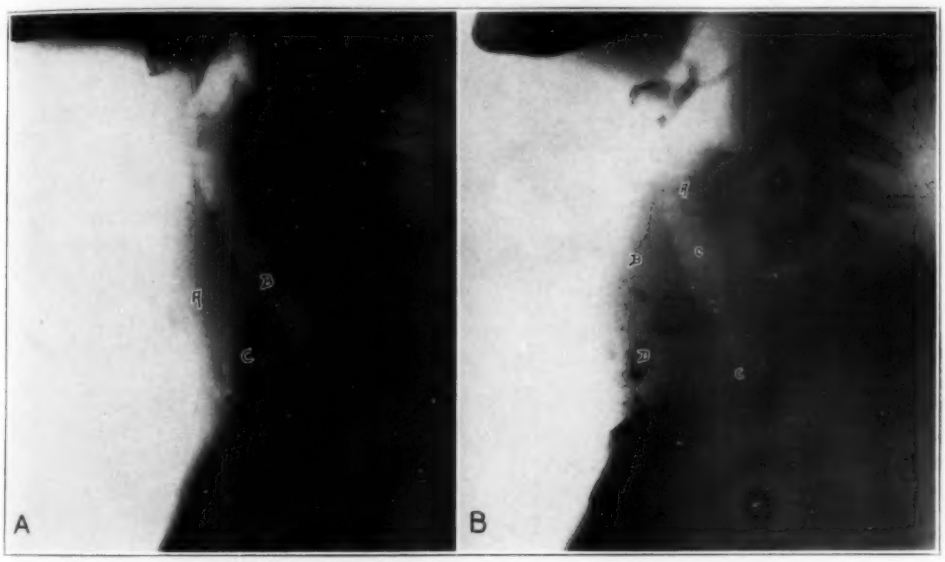

Fig. 13.—*A*, (C. C., a woman, aged 45; diagnosis, simple colloid goiter) there is a symmetrical, moderate enlargement of the thyroid gland, with relatively slight tracheal compression. A, goiter; B, trachea, and C, sternocleidomastoid muscle. *B*, (E. K., a middle-aged woman, diagnosis, colloid goiter) the goiter is the seat of calcareous degeneration. The cervical trachea is almost collapsed anteroposteriorly. A, larynx; B, colloid goiter; C, trachea showing stenosis, and D, calcareous deposits.

to be pathognomonic for carcinoma of the larynx with extension into the cartilage.

Tumors of the pyriform sinuses are rarely visible while they remain small and confined to this location, but they usually extend to adjacent areas, such as the arytenoid cartilages, aryepiglottic folds and epiglottis, where they stand out well against the background of the air-containing pharynx.

Tuberculosis of the larynx gives a hazy, indistinct outline. The cartilage underlying the mucous membrane is affected by this disease with resultant absorption, similar to the rarefaction that characterizes tuberculous osteitis. The infiltration of the soft parts, particularly the arytenoid cartilages, is occasionally visible. The same roentgenogram may display a group of calcified cervical lymph nodes.

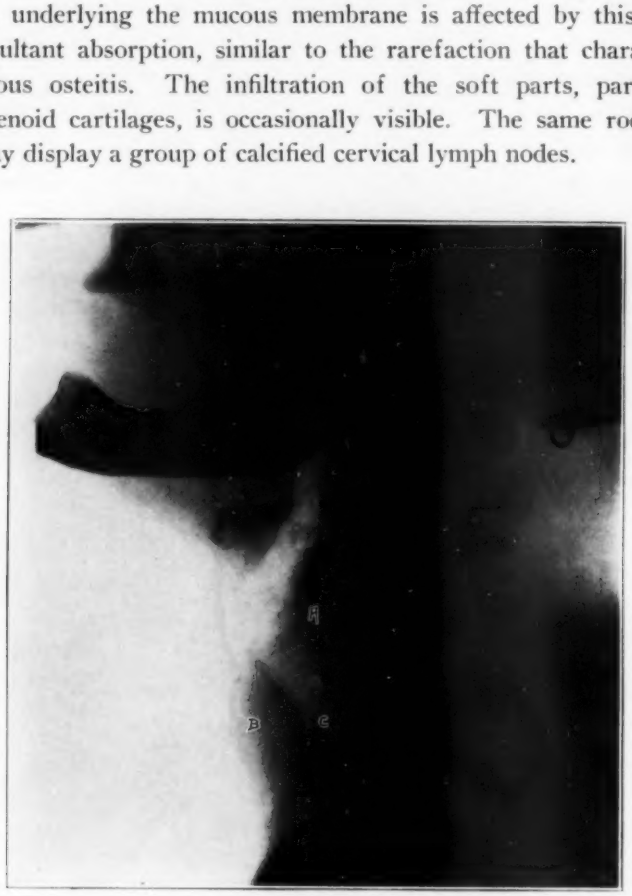

Fig. 14 (S. F., a woman, aged 59; diagnosis, adenoma of the thyroid).—Both lobes of the thyroid contain soft, elastic nodules. There is one distinct nodule just above the isthmus. In the anteroposterior view the trachea and upper mediastinum are displaced to the right. The larynx is normal. Ossification is well advanced in the cricoid cartilage. The trachea is slightly compressed anteroposteriorly. *A*, ossification of the cricoid cartilage; *B*, adenoma of thyroid, and *C*, stenosis of tracheal lumen.

In contradistinction to tuberculosis, syphilis of the larynx usually produces proliferation rather than resorption of bone. In Thost's early studies in 1913, he called attention to the sharp, distinct pictures of the ossified portions of the syphilitic larynx. He also described the roentgen appearance of the urate deposits in the "gouty" larynx.

TUMORS OF THE ORAL PHARYNX

Retropharyngeal abscess and Pott's disease of the cervical vertebrae are characterized in the lateral roentgenogram by an opaque convex protrusion into the pharyngeal cavity. A tumor that simulates these diseases in the roentgenogram is the retropharyngeal neurofibroma or neurogenic sarcoma, of which an illustrative case report is herein included.

The smooth convex dorsum of the base of the tongue is interrupted by carcinomas or aberrant thyroid masses of this region which appear in silhouette against the less dense pharynx. The natural concavities of the valleculae are obliterated by carcinomas that occur in this location. The clear outline of the epiglottis is distorted by carcinomas that may replace this structure with bulky tumors or completely destroy it by erosion.

Roentgen examination of these structures is not intended as a substitute for direct palpation and inspection with a mirror, but rather as a supplementary method.

TUMORS OF THE THYROID GLAND

The sternocleidomastoid muscle may overlap the thyroid gland and partly obscure its delineation in the lateral roentgenogram. All tumors of the thyroid as well as goiters are more opaque to x-rays than are the adjacent tissues of the neck. Calcareous degeneration of goiters is readily detected by this method.

Goiter is the most frequent cause of changes in the form and position of the trachea. When the trachea is flattened anteroposteriorly, the column of air is so narrow in this tube that the x-rays passing through will barely create a visible picture, except with a lateral exposure. The advantages of lateral roentgenography in the case of thyroid enlargement are several. It enables the diagnostician to recognize the presence of a substernal goiter. It is a worthwhile prerequisite measure for operations on the thyroid. Some very large goiters may cause no symptoms referable to pressure on either the trachea or the esophagus; this is true particularly if their growth has been slow. The dyspnea produced by this pressure has no direct relationship to the size of the goiter; small nodules of the thyroid may grow posteriorly to impinge on the trachea and compress it, with consequent stridulous respiration. The pressure on the trachea may be sufficiently great and constant to induce actual tracheomalacia. Even if the patient has had no previous dyspnea, it is advisable to take a lateral roentgenogram, because a sudden attack of dyspnea is always a possibility. The dyspnea accompanying goiter is not a specific sign of tracheal stenosis, as it may be

Fig. 15 (O. S., a woman, aged 27; diagnosis, adenoma of the thyroid gland).—The right lobe of the thyroid gland contains a firm mass, 5 cm. in diameter. *A*, hyoid bone; *B*, early calcification of the cricoid cartilage; *C*, adenoma of the thyroid, and *D*, trachea.

Fig. 16 (T. C., a woman, aged 40; diagnosis, adenocarcinoma of the thyroid gland).—A previous attempt at surgical removal was unsuccessful. At present the infiltrating carcinoma has produced a diffuse ligneous thyroid mass which surrounds the trachea and the lower part of the thyroid cartilage. The cervical trachea is compressed anteroposteriorly. *A*, epiglottis; *B*, cricoid cartilage; *C*, ventricle of Morgagni; *D*, thyroid carcinoma, and *E*, lumen of the trachea.

of pulmonary or cardiac origin; one is surprised at times at the incongruity between the degree of dyspnea and the amount of tracheal compression revealed by the roentgenogram.

Carcinoma of the thyroid gland presents a similar roentgen appearance. The only discernible difference is the tendency toward infiltration of the trachea. In such a case the carcinoma may perforate the tracheal wall and appear in the roentgenogram as an opaque polypoid nodule in the otherwise patent tracheal lumen; the transverse opacities of the tracheal rings are situated anterior to this portion of the tumor.

SUMMARY

1. Lateral roentgenograms of the neck are a useful supplementary means of studying tumors of the larynx and thyroid.

2. Tuberculosis of the larynx gives a hazy, indistinct outline, owing to the invasion of soft parts and the rarefaction of the ossified cartilages. Syphilis of the larynx presents a picture of sharp, distinct ossified areas, owing to increased proliferation of bone.

3. Lateral roentgenograms reveal the anteroposterior compression, tracheal stenosis and tracheomalacia produced by certain types of goiter and by tumors of the thyroid gland.

4. Carcinoma of the thyroid may perforate the trachea to form an intratracheal tumor, easily visualized on the roentgenogram.

5. Lateral roentgenograms of the neck exhibit the outlines of retropharyngeal tumors. Some of these growths are inflammatory, whereas others are neoplastic, e. g., neurogenic.

6. Carcinomas of the base of the tongue, valleculae, epiglottis and aryepiglottic folds distort the lateral silhouettes of these structures to produce a characteristic roentgenogram.

7. Intrinsic laryngeal cancers obliterate the light oval areas on the roentgenogram which represent the ventricles of Morgagni.

8. The peculiar punched-out appearance of the thyroid cartilage as seen in the roentgenogram is almost specific for laryngeal cancer.

THE FUNCTIONS OF THE EUSTACHIAN TUBE

ITS RELATION TO CHRONIC DISEASES OF THE MIDDLE EAR *

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It is an established fact that the eustachian tube plays a major part in protecting the middle ear from nasopharyngeal pathologic influences. On the other hand, when the eustachian tube is not functioning normally, it becomes a contributing factor to impairment of the middle ear. After four years of uninterrupted observation on the pathology of the eustachian tube, there are a few personal observations I should like to add to the literature on this subject.

The eustachian tube is the chief source of communication between the epipharynx and the middle ear. The direction of the eustachian tube, beginning from the epipharynx, is upward, backward and outward. It is a bitrumpet canal, with the two narrowest portions facing each other, and is known as the isthmus. The tympanic trumpet has an osseous framework and is therefore constantly open. The pharyngeal trumpet is the gate to the middle ear. It opens and closes, and therefore plays the major physiologic and protective function for the middle ear.

When closed, the pharyngeal portion of the eustachian tube is made up of two adjacent vertical walls—anterior and posterior—lined by ciliated columnar epithelium.[1] The posterior wall is supported by the right triangular cartilage, the upper margin of which is hinged in a groove in the base of the skull, while its lower margin is freely movable. The inner or pharyngeal border of the cartilage is free and projects slightly within the nasopharynx to form the torus tubarius. The anterior wall of the tube rests on the tensor palati muscle and that in turn on the levator palati muscle and the intervening fascia. The fibers of the levator palati and the tensor palati muscles both run parallel with the long axis of the tube. The levator palati muscle is chiefly responsible for the opening of the eustachian tube, for its inner extremity is attached to the muscular mass of the velum palatinum and moves with the soft palate. When the soft palate is relaxed and hangs forward, the palati attachment of the levator is drawn downward and

* Submitted for publication, Dec. 3, 1930.

* From the Ear, Nose and Throat Clinics of Mount Sinai, Beth David and Sydenham Hospitals.

1. Bryant, Sohier W.: The Eustachian Tube: Its Anatomy and Its Movement, M. Rec., June 8, 1907.

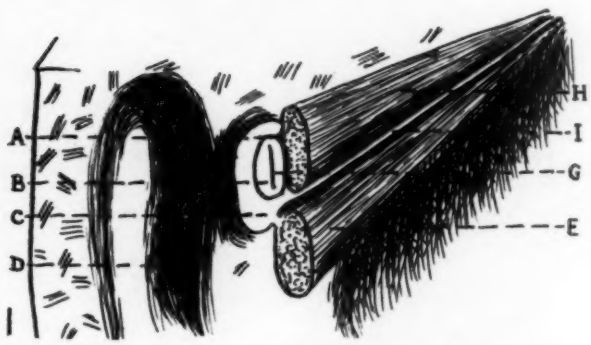

Fig. 1.—The left tube at a cross-section; 2 mm. of the pharyngeal end has been removed. The fibers of both tensor and levator muscles are seen running parallel to the tube and are separated by the salpingopharyngeal fascia. The levator palatine is seen resting on the anterior surface of the angular process of the cartilage. *A* indicates the hamular process of the triangular cartilage; *B*, the mucous membrane lining the tube; *C*, the triangular cartilage; *D*, the fossa of Rosenmuller; *E*, the levator palatine muscle; *G*, a section of the closed tube; *H*, the tensor palatine muscle, and *I*, the fascia between the tensor and levator palati muscles.

Fig. 2.—The same view as in figure 1, but the levator palati has been drawn upward and backward into the position it occupies when the soft palate is raised. It now pushes the angular process of the cartilage upward and backward, encroaches on the lumen of the fossa of Rosenmuller and opens the tube. The anterior wall of the tube remains fixed. *A* indicates the fossa of Rosenmuller; *B*, a section of the tube opened; *C*, a cartilaginous portion of the tube; *D*, the levator palatine muscle; *G*, the tensor palati muscle, and *H*, fascia between the tensor and levator palati muscles.

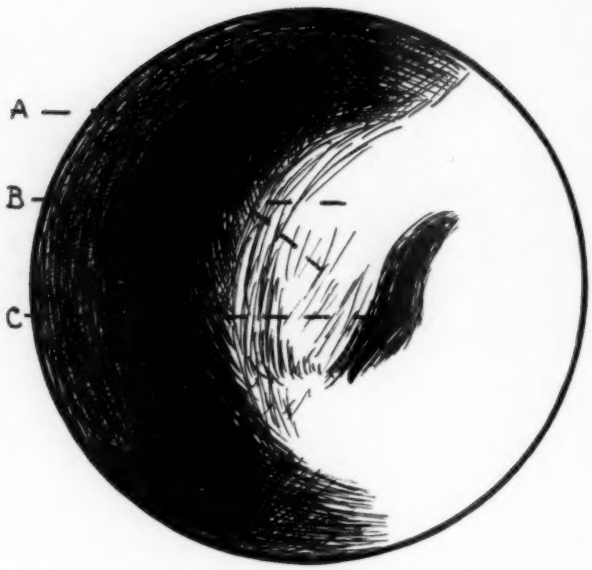

Fig. 3.—The pharyngeal orifice of the left eustachian tube as seen with the aid of a nasopharyngoscope, when at rest. *A* indicates the fossa of Rosenmuller; *B*, the torus tubarius; *C*, the mouth of tube closed.

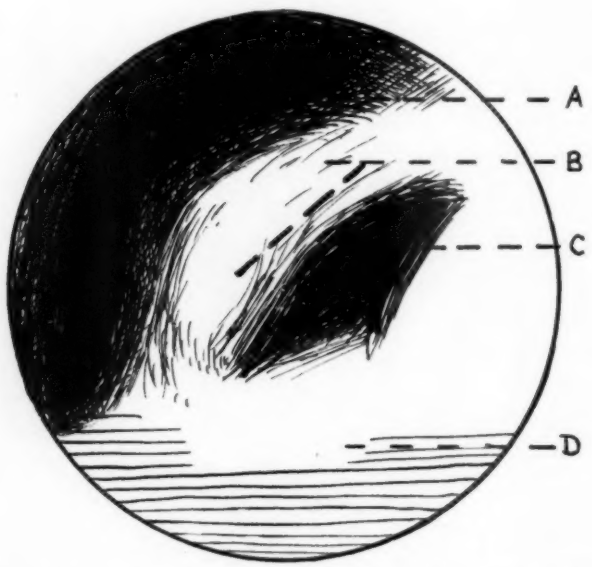

Fig. 4.—The same section as in figure 3, but during the act of swallowing. The fossa of Rosenmuller is nearly closed by the backward and upward movement of the alar cartilage, which has distended the tube. *A* indicates the fossa of Rosenmuller; *B*, the torus tubarius; *C*, the mouth of the tube opened, and *D*, the soft palate. The same picture is seen when the tube is pathologically open, not only during the act of swallowing but when at rest.

forward. If the palate is drawn upward and backward, the inner attachment of the levator palati muscle pushes the alar cartilage backward, upward and inward, for the direction of the eustachian tube compels the triangular cartilage to move in that direction. The opening and closing movement of the pharyngeal end of the eustachian tube can be well observed with the aid of a nasopharyngoscope. When the tube is closed, one sees a vertical slit. During the act of swallowing, the soft palate rises, and there is also observed a concomitant movement of the alar cartilage. The ala is seen to rise, moving backward and inward, and at the same time the mouth of the tube changes its shape from a vertical slit to a triangular opening formed by the backward movement of the posterior part of the closed tube. The anterior wall remains stationary. The inferior wall of the open tube is formed by the stretched inferior commisure.

FUNCTION

The eustachian tube has both a physiologic and a protective function.

The Physiologic Function.—It is the only channel of communication between the nasopharynx and the middle ear for the purpose of equalizing the pressure of the external air and that contained in the middle ear.

The Protective Function.—A conscientious investigation of the literature revealed only one protective function credited to the eustachian tube; that is, the tube is lined with ciliated columnar epithelium having a wavelike motion toward the pharyngeal orifice.

I have observed two other protective functions of the eustachian tube, which are as follows:

1. The torus tubarius, which is the free margin of the right triangular cartilage of the eustachian tube and projects within the nasopharynx, moves backward, upward and inward when the tube is opened. With this movement it sweeps backward and away from the orifice of the tube any secretion surrounding it. In this way it keeps the orifice of the eustachian tube free from secretions.

2. When changing from a vertical slit to a triangular opening, the pharyngeal orifice of the eustachian tube, by its opening movement, breaks up the surface tension of any film of secretion that may be stretched across the orifice. In this way it causes the film of secretion to collapse, and the orifice to the eustachian tube is kept open for ventilation of the middle ear.

It works in the same way as if a film of soap were stretched across two approximated adjacent fingers; when the fingers are separated, the film of soap immediately collapses, for its surface tension is destroyed.

RELATION TO DISEASES OF THE MIDDLE EAR

I shall outline the influence of the eustachian tube on diseases of the middle ear, secondary to nasopharyngeal impairment. To simplify matters, it is advisable to study each portion of the eustachian tube separately—the tympanic, the isthmus and the pharyngeal portions.

The Tympanic Portion.—As this portion has an osseous framework, it plays little part in influencing chronic impairment of the middle ear. There are times, however, when tympanic accessory cells open in that

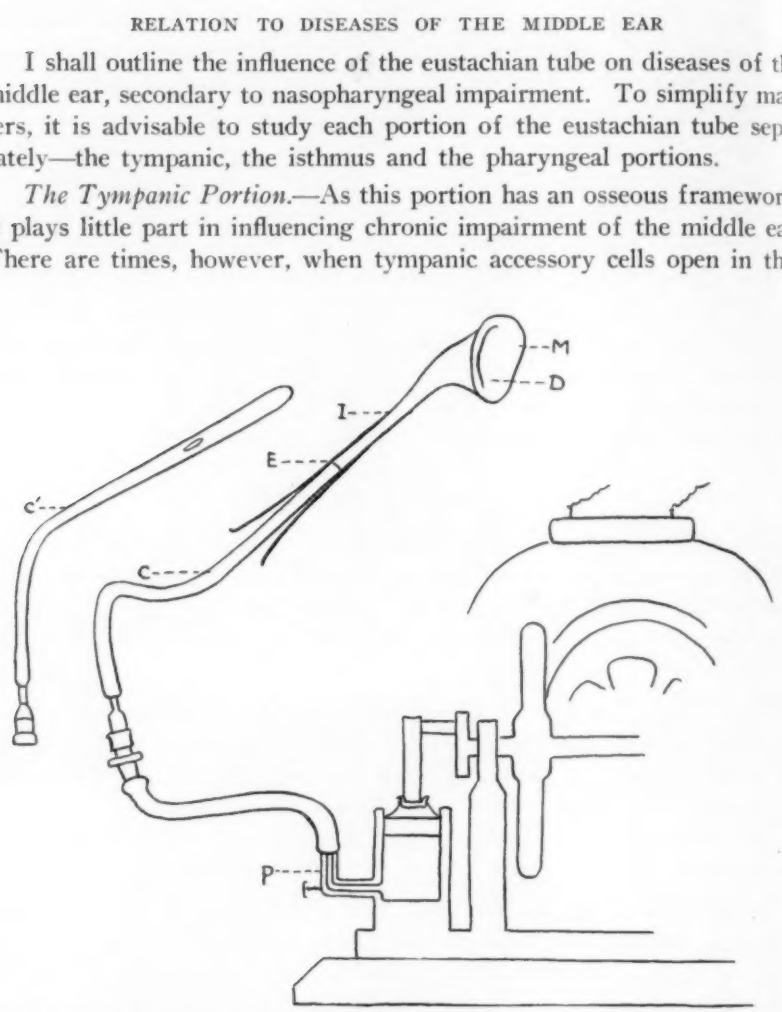

Fig. 5.—Schematic outline of the apparatus used to test the patency of the tube. *P* indicates the nipple of the vibratory apparatus; *E*, the eustachian tube with a portion of the catheter tube, *C*, having a forward outlet, inserted; *I*, the isthmus of the eustachian tube; *M*, the middle ear; *D*, a cross-section of the drum membrane, and *C*, a catheter having a side outlet.

portion of the tube, and should they become chronically infected they may cause a chronic discharge from the middle ear.

The Isthmus.—As this is the narrowest portion of the eustachian tube, one can easily conceive that in an acutely inflamed tube a congestive swelling will obstruct that portion of the tube. However, to my mind, it is questionable whether the isthmus is ever obstructed in

chronic diseases of the middle ear secondary to nasopharyngeal impairment. I reached that conclusion by the following experiment.

By means of my catheterizing eustachioscope, a no. 6 kidney catheter having a forward outlet was introduced into the right eustachian tube leading to a normal ear until it met resistance. A no. 6 kidney catheter was selected because its thickness will not permit its advance to the isthmus and surely not beyond the isthmus. A hypodermic needle was inserted at the outer end of the catheter. This needle must fit snugly, so that air does not escape. The needle was then attached to a tube leading to an outlet nipple of a pneumomassage pump producing compression and rarefaction of air, regulated at a pressure of 3 pounds. The pump was then permitted to run for exactly forty-five seconds.

The drum membrane was observed to vibrate with the vibrations of the pump. The diagnostic tube used during the vibration gave a soft blowing sound, characteristic of a patent tube. At the end of vibration, a reddening of Shrapnell's membrane and along the handle of the malleus (Troelisch's stripes) was observed.

The same procedure was tried on the left eustachian tube, but a new kidney catheter was substituted having only a side outlet 1½ inches (3.77 cm.) away from the forward end, while that was sealed. This permitted the escape of air only through the opening in the side. In this way it was impossible for any air to escape into the eustachian tube or the middle ear.

No movement was observed during the vibration of the pump. The characteristic blowing sound present in a patent tube was absent. At the end of the period of vibration, there was no discoloration of any part of the drum. This proved that no air entered the middle ear.

The same observations were recorded in nine more consecutive, normal cases. The same catheters, the pump with the same pressure and forty-five seconds of vibration were used.

Twenty-five consecutive cases in which there was bilateral impairment of the middle ear, with marked retractions and ankylosis of both drums, were selected for observation. The experiment outlined was repeated in detail in each case as in the normal cases. The observations were the same in all except one questionable case. There was the artificial reddening of Shrapnell's membrane and around the handle of the malleus, on the right but not the left side. The characteristic blowing sound of a patent tube was present on the right side, but was absent on the left. The lateral vibration of the drum was of no importance, for the drums were retracted and ankylosed, and therefore vibration was not always present.

I am therefore led to believe that in these cases obstruction at the isthmus is not as common as is supposed.

The Pharyngeal Portion.—This portion of the tube is the gate to the middle ear. It opens only when the middle ear needs ventilation, but is otherwise closed, so intended by nature to protect the middle ear from unnecessary exposure from the nasopharynx.

One can readily see that if the tube is kept constantly closed, owing to ankylosis of the alar cartilage, or to thickening of the epithelial and subepithelial layers, the pressure of air in the middle ear will become diminished, followed by a retraction of the drum, etc.

On the other hand, if the tube is constantly kept open by pathologic means, the protective function of the pharyngeal portion of the eustachian tube is greatly destroyed. The torus tubarius will no longer be able to sweep backward and away from the orifice of the eustachian tube any secretion surrounding it. The pharyngeal orifice of the eustachian tube, having lost its opening movement, will no longer be able to break up the surface tension of a film of secretion that may be stretched across the orifice of the eustachian tube. When the head is inclined to one side, mucus will gravitate down the middle ear through the open tube, causing ankylosis of the drum and ossicles, etc.

The hypertrophied tonsil is a chief cause for a pathologically open tube.[2] I found this to be so, on account of its anatomic position, for the inner extremity of the levator palati muscle is immediately above the dome of the tonsil. One can readily see that a high-domed, hypertrophied tonsil, on account of its upward pressure, tends to elevate the levator palati muscle, which in turn pushes the alar cartilage backward, upward and inward, and causes the pharyngeal orifice of the tube to remain open.

736 West End Avenue.

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CONJUGATE DEVIATION OF THE HEAD AND EYES

ITS VALUE IN THE DIAGNOSIS AND LOCALIZATION OF ABSCESS OF THE BRAIN *

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This paper is based on a study of twenty-four cases of abscess of the brain which came under my observation during the last two years. These include eight cases of abscess of the temporal lobe, six of abscess of the frontal lobe (four in the prefrontal region, and two in the posterior part of the lobe), two of abscess of the parietal lobe, one of abscess of the occipital lobe and seven of abscess of the cerebellum. These cases, with the exception of four private cases, were seen by me in the neurologic service of the Los Angeles County General Hospital, to which they were referred, chiefly for diagnosis, by the eye, ear, nose and throat service and the meningitis division of the contagious disease department.

In all of these cases the final diagnosis, on which this paper is based, was established either by operation or by postmortem examination, in twelve of these by the latter process. Postmortem examination confirmed the clinical diagnosis in all but one case, in which the patient, when seen for the first time, presented symptoms that were diffuse and ambiguous (however, as will be seen further on, a closer analysis of the observations in this case showed them to be in full accord with the conclusions as set forth in this communication, the error having been due to a misinterpretation of the symptoms). It will be well to state in this connection that quite a few of the patients were in a state of stupor when admitted to the hospital, and were either unaccompanied by relatives or friends so that no history of a preceding infection of the ear, sinuses or other organs was obtainable, or, as it happened in two instances, positive assurance was obtained that the patient had had no preceding infection, and that he was entirely well until he became

* Submitted for publication, Oct. 30, 1930.

* Presented by invitation before the Research Study Club, Sections of Ophthalmology and Oto-Laryngology, Los Angeles County Medical Association, March 17 and June 2, 1930. On the latter date I demonstrated motion pictures of cases 4 and 10, which showed the rotation of the head and eyes, the nystagmus, the ataxia and the other motor disturbances presented by these patients.

sick with headache, drowsiness and other symptoms shortly before his admission to the hospital. As the patient in his stuporous condition could not be submitted to neurologic tests requiring his cooperation (tests for coordination, sensation, speech, etc.), reliance in making the diagnosis had to be placed entirely on the objective observations. Among these I found conjugate deviation of the eyes to be exceedingly valuable, and it is my object in this communication to report my observations and conclusions concerning this phenomenon in its bearing on the diagnosis and localization of abscess of the brain.

THE CORTICAL CENTERS FOR CONJUGATE DEVIATION OF THE HEAD AND EYES

Conjugate deviation of the eyes, or, as it is more commonly observed, conjugate deviation of the head and eyes, may be obtained experimentally by stimulation of various regions of the brain.

In 1870, Fritsch and Hitzig [1] were the first to observe movements of the head and eyes to the opposite side on stimulation of the presigmoid area in the dog with galvanism. Following this observation, Ferrier,[2] using the faradic current, obtained such movements from the posterior third of the middle frontal convolutions in the ape. These observations were confirmed by Horsley and Schäfer,[3] Sherrington and Grünbaum [4] and others.

Another area the excitation of which produces a deviation of the head and eyes to the opposite side is the visual zone of the occipital lobe (the posterior extremity of this lobe and the region around the lips of the calcarine fissure). This was first noted by Schäfer in the monkey,[5] and was confirmed by Ferrier and others. Munk, by his studies on the dog, demonstrated the independence of this center from the frontal center.

Still another region of the brain, the electric stimulation of which was shown by Ferrier to give rise to conjugate deviation of the head

1. Fritsch and Hitzig: Ueber de electrische Erregbarkeit des Grosshirns, Arch. f. Anat., Physiol. u. wissenschaft. Med. **37**:300, 1870. Hitzig, E.: Untersuchungen über des Gehirn, Berlin, H. Hirschwald, 1904.

2. Ferrier, D.: The Functions of the Brain, ed. 2, New York, G. P. Putnam's Sons, 1886.

3. Horsley, V., and Schäfer, E. A.: A Record of Experiments upon the Functions of the Cerebral Cortex, Phil. Tr., 1888, London **179**:1, 1889.

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5. Schäfer, E. S.: Experiments on the Electrical Excitation of the Visual Area of the Cerebral Cortex in the Monkey, Brain **11**:1, 1888.

and eyes to the opposite side, is the first temporal convolution, the region of the brain that, according to this investigation, is the center of hearing.

While the precise character of this convolution as an auditory center is a moot subject, Munk maintaining that its destruction in animals gives rise not to true deafness but to a form of psychic deafness something akin to sensory aphasia in man, it was confirmed by subsequent investigators that the excitation of this region is followed by turning of the head and the eyes to the opposite side.

Conjugate deviation of the head and the eyes to the opposite side may finally be obtained, it was shown by Ferrier and Bernheimer, by stimulation of the parietal lobe in the region of the angular and supramarginal gyri.

As to the physiologic significance of the deviation of the head and the eyes, the movement was generally interpreted as signifying a focusing of attention on the object looked at, for the purpose of bringing it within the region of central vision. It is evoked, according to Munk, on excitation of the visual zone, owing to the fact that excitation of this zone awakens in the animal a visual impulse from the contralateral field of vision, and the animal directs attention to it by turning the head and the eyes in its direction. Excitation of the parietal lobe similarly awakens a sensory impulse in the realm of general sensibility (touch, pain, muscle sense) on the opposite side of the body, causing the animal, in similar fashion, to look toward the point experiencing this sensation; the same is true in the case of stimulation of the auditory center. Ferrier accordingly considered the frontal area for conjugate deviation of the head and eyes as the motor center for voluntary movements of attention, the center of what Wundt designated as aperception.

As to conjugate deviation of the head and eyes in man, it has been studied but little by electric stimulation of the brain. It is, of course, well known that irritation of the brain, especially when acute, as in the case of hemorrhage from injuries over one hemisphere, frequently produces convulsions on the other side of the body, which are ushered in by movements of the head and eyes toward that side. The exact focus of irritation in these cases giving rise to the movement of the head and eyes has not, however, been definitely established.

Much more familiar in man is the conjugate deviation of the head and the eyes which is brought about by a destructive lesion of the brain, in which case, the head and the eyes are turned toward and not opposite the lesion. (The power to move the eyes to the opposite side is lost.) It may be observed almost constantly in cases of hemorrhages of considerable severity in the region of the internal capsule, in which condition, as stated by Vulpian, "the patient looks at his lesion." Conjugate deviation in these cases is of short duration, as it gradually, within a

few days to a few weeks, with the absorption of the hemorrhage and subsidence of the acute phenomena, passes off. As the lesion in these cases involves the fiber tracts from various zones of the brain, it gives little information regarding the center of the movement of the head and the eyes in the cortex of the brain. Wernicke's classic and oft quoted case,[6] in which conjugate deviation of the head and eyes was produced, as he supposed, by softening of the angular gyrus, had small, similar lesions in other parts of the brain. Conjugate deviation of the head and the eyes has been noted by Gordon Holmes and by Kolodnay[7] in some cases of tumor of the frontal and of the temporal lobe. It has also been noted in a case of tumor of the temporal lobe by Bianchi;[8] but in this case the tumor also involved the basal ganglia and extended to the corpus callosum.

Foerster,[9] in a recent paper, postulated the center to be in Brodman's cytotectural field, no. 19 (corresponding to the parieto-occipital area). Purves-Stewart[10] reported a case of persistent deviation of the head and the eyes in which there was a large glioma in the region of the left precentral and postcentral convolutions.

It appears to me that definite conclusions are difficult to reach from cases of tumor of the brain, as (1) owing to the slow development of the tumor, the deviation of the head and the eyes is being gradually compensated through the activity of the subsidiary and unaffected cortical centers, and (2) tumors are seldom so circumscribed as to exhibit their effect on a limited area, so that the deviation when present may with justification be ascribed to structures at a considerable distance from the main site of the lesion. The evidence obtained from an abscess of the brain is therefore, in my judgment, far more valuable. The abscess is acute, and, within certain limits, is a steadily expanding lesion. It develops within a few days to a few weeks, becoming at the same time walled off and circumscribed. The conjugate deviation, when present, in contradistinction to that occurring in apoplexy, does not recede, but becomes more and more pronounced unless the abscess becomes chronic, when the deviation, probably through the action of the

6. Wernicke, Carl: Herderkrankung des untern Scheitelläppchen, Arch. f. Neurol. u. Psychiat. **20**:243, 1889.

7. Kolodnay, A.: Symptomatology of Tumors of the Frontal Lobe, Arch. Neurol. & Psychiat. **21**:1116 (May) 1929; Symptomatology of Tumors of the Temporal Lobe, Brain **51**:385, 1928.

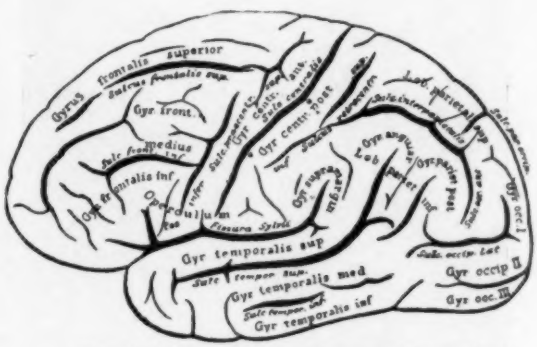
8. Bianchi, Leonardo: The Mechanism of the Brain and the Functions of the Frontal Lobes, New York, William Wood & Company, 1922, p. 54.

9. Foerster, O.: Die Topic der Hirnrinde in ihrer Bedeutung für die Motilität, Deutsche Ztschr. f. Nervenh. **77**:124, 1923.

10. Purves-Stewart, James: Intracranial Tumors and Some Errors in Their Diagnosis, London, Oxford University Press, 1927, p. 19.

subsidiary centers, subsides. The presence of the phenomenon and increasing intensity during the formation of an abscess in certain regions of the brain is, therefore, in my experience, of great diagnostic and localizing value, and should be carefully looked for in all cases in which such a lesion is suspected.

The phenomenon, when present, is generally marked and offers no difficulty of detection. In some cases, however, as when the abscess is situated at some distance from the special center for the movement of the eyes, or when the abscess has attained a certain degree of chronicity, it may be present in a minor degree only. It can then be determined (1) by asking the patient to look to one side and the other, when it will be seen that on attempting to look in the direction opposite that of the deviation of the eyes, he is unwilling to move his eyes, but turns his



External aspect of left cerebral hemisphere. The names of the gyri and lobules are marked in Roman type those of the sulci and fissures in italics.

Fig. 1.—Normal brain of man, showing various convolutions. (From Lucian: Human Physiology, New York, The Macmillan Company, 1915, vol. 3, p. 531.)

head in that direction, exerting pressure on the examiner's hand, and (2) by a marked persistence of the deviation of the head and the eyes as the slow component of nystagmus, when the latter phenomenon is evoked by stimulation of the labyrinth with the "cold caloric" on the side toward which the eyes deviate spontaneously, and the consequent delay in the development of the quick component to the other side. In cases of supratentorial abscess, my observations were as follows:

CASE 1.—*Slight but fairly noticeable conjugate deviation of the head and the eyes toward the side of the lesion in the case of a small, circumscribed abscess in the posterior part of the right frontal lobe, adjacent to the ascending frontal convolution.*

J. H., aged 35, a private patient, seen in consultation with Dr. Norman C. Paine, at Glendale, Calif., on Dec. 8, 1929, had been subject to colds for years. His tonsils had been removed about a month before examination. Headaches, which steadily increased in severity, set in about two weeks following the tonsil-

lectomy. He had remained in bed during the last three days, when his headaches were uncontrollable; there was no vomiting.

Examination.—The patient was drowsy; the eyes were half closed. He cerebrated slowly, but answered questions (after some delay) correctly. The pupils were dilated (homatropine), the left being slightly larger than the right. The left pupil reacted somewhat to light; the right did not. There was no nystagmus. He showed a tendency (slight) to conjugate deviation of the eyes to the right. There was no aphasia (the patient was left-handed but wrote with his right hand). There was a definite though not marked weakness of the left side of the face

Fig. 2 (case 1).—Coronal section of the brain, anterior view, showing the abscess in the posterior part of the frontal lobe.

and the left arm. The reflexes were active, and a Babinski sign was present on both sides. There was slight ankle clonus on the left side. The abdominal and cremasteric reflexes were absent on the two sides. There was no astereognosis, and apparently no hemianopia. There was no ataxia in the arms, and no past-pointing. There was anosmia on the right side. The region of the fifth nerve was more sensitive on the right side. The fundi were clear on the temporal side and slightly blurred on the nasal side; the retinal vessels were more prominent on the right side. There was considerable cervical rigidity, but no Kernig sign. Roentgenograms showed some clouding of the sphenoids. Examination of the blood showed: leukocytes, 12,000, and polymorphonuclears, 80 per cent. The

spinal fluid was clear, under greatly increased pressure; there were 17 lymphocytes per cubic millimeter of fluid, some globulin and an increase of sugar content (80 mg. per cubic millimeter of fluid).

Diagnosis.—The diagnosis was abscess of the frontal lobe of the left side.

Operation.—The patient was operated on by Dr. George Patterson a few hours later, and the abscess was drained. He died ten days later.

Necropsy.—Postmortem examination revealed a circumscribed abscess in the posterior part of the right frontal lobe adjacent to the area of the arm of the ascending frontal convolution (fig. 2).

In another case of abscess of the frontal lobe on the left side with a fairly well marked conjugate deviation of the head and the eyes toward the side of the lesion which I saw in consultation with Dr. Samuel Sweazy recently, the paralysis that was ushered in by localized spasms first affected the face, giving rise at the same time to motor aphasia, then the arm and finally the leg. The abscess, on the left side in this case, also involved the ascending frontal convolution. The patient was operated on and has now practically recovered.

CASE 2.—*Extreme conjugate deviation of the head and the eyes to the side of the lesion in the case of an abscess in the region of the angular gyrus of the right parietal lobe.*

W. S. MacC., aged 32, married, was admitted to the hospital on Jan. 1, 1930, as having a tumor of the brain and was assigned to the neurologic service. The patient gave the following history: He had always been in good health. He had had an attack of rhinitis about six weeks before admission, which was followed by numbness and weakness in the left hand, and later in the arm and the leg. The symptom became worse progressively. He had three attacks of generalized convulsions, and the paralysis on the left side became complete. While he was at the hospital, during the following four days, his temperature ranged from 97 to 99 F., and the pulse rate from 48 to 70.

Examination.—The leukocyte count was 15,000, with 73 per cent polymorphonuclears. A roentgenogram of the skull and the sinuses was unsatisfactory, owing to the patient's inability to cooperate. Examination of the spinal fluid showed: clear fluid under increased pressure, 3 lymphocytes, sugar considerably increased and globulin negative.

On January 5, neurologic examination showed: There was extreme conjugate deviation of the head and the eyes to the right (fig. 3). The pupils were regular, but unequal; the left was wider than the right. Both pupils reacted to light. There was no nystagmus. Speech and intelligence were unaffected, but the patient was drowsy and suffered from excruciating headache. He showed a left hemiplegia with considerable spasticity. (Note the position of the left hand in fig. 3.) There were a Babinski sign and ankle clonus on the left side, and a slight Babinski sign on the right. The deep reflexes were spastic on both sides, more so on the left. The cremasteric reflex was lost on the left, but was present on the right side. All types of sensation were diminished on the left side; astereognosis was present on that side. There was apparently no hemianopia. There was no paralysis of the palate or the pharynx. The hearing was good on the two sides by both air conduction and bone conduction. The left fundus was clear; the right was blurred on the nasal side. There was no anosmia. There was a slight cervical rigidity, but no Kernig sign.

Fig. 3 (case 2).—Appearance of patient, showing extreme conjugate deviation of the head and eyes to the right.

Neuro-otologic examination disclosed: The patient was recumbent. On stimulation of the horizontal canal on the right side with cold water, there was a persistent, possibly increased conjugate deviation of the eyes to the right but no nystagmus, although the irrigation was continued for more than three minutes. (This is in accord with the results I obtained in cases of apoplexy with hemiplegia, in which, during the period the patient had conjugate deviation of the eyes toward the side of the lesion, I found it impossible to evoke a nystagmus to the opposite side.[11]) On stimulation of the left labyrinth in the same manner, after twenty-five seconds, the patient showed a horizontal nystagmus of large amplitude to the right, which persisted for over three minutes. He had good systemic response on stimulation of either labyrinth. Owing to the resistance of the patient, the vertical canals and past-pointing could not be tested.

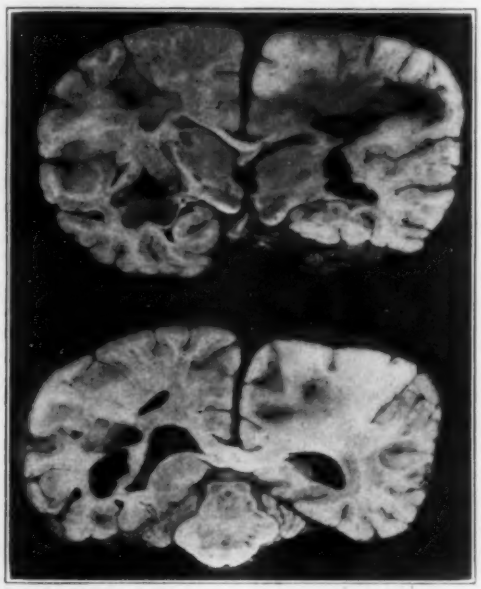


Fig. 4 (case 2).—Coronal section of the brain, posterior view, showing the abscess in the region of the angular gyrus of the parietal lobe.

Diagnosis.—The diagnosis was abscess of the brain in the region of the right parietal lobe.

Operation.—On January 7, the patient was operated on, and the abscess was drained. He died on January 10.

Necropsy.—Postmortem examination revealed a circumscribed abscess in the region of the angular gyrus of the parietal lobe (fig. 4).

In another case of abscess of the right hemisphere with extreme conjugate deviation of the head and the eyes to the right, the abscess, as shown by operation, was situated in the parietal lobe but more anteriorly, involving also the rolandic region. The patient was admitted

11. Meyers, I. Leon: Nystagmus: Neuro-Otologic Studies Concerning Its Seat of Origin, Am. J. M. Sc. **169**:742 (May) 1925.

to the hospital on April 5, 1929, was operated on the same day, and died on April 8. There was no postmortem examination.

I saw no evidence, although it was carefully looked for, of conjugate deviation of the head and the eyes, or of the eyes alone in any of the cases of abscess of the temporal lobe, although the abscess in some of these cases was extensive (fig. 5), nor in the case of abscess of the occipital lobe, which also was extensive, almost completely destroying that lobe.

CONJUGATE DEVIATION OF THE EYES IN ABSCESS OF THE CEREBELLUM

Of particular importance for the diagnosis and localization of the lesion is the conjugate deviation of the eyes to the side opposite the

Fig. 5.—Coronal section of the brain, anterior view, showing the extensive abscess of the temporal lobe. The patient showed no evidence of conjugate deviation of the head and eyes.

lesion, which occurs in association with abscess of the cerebellum. The phenomenon as a manifestation of cerebellar deficiency has been described before by Andre-Thomas,[12] who noted it following oblation of a cerebellar hemisphere in a dog. A deviation of the eyes to the same side, as an irritative phenomenon, has been noted by R. H. Clarke [13] on electric stimulation of the organ in the ape. In his experiments the response gradually increased in intensity as the points of the electrodes

12. Andre-Thomas: Cerebellar Functions, Nervous and Mental Disease, Monograph Series, New York, 1912, no. 12.

13. Clarke, R. H.: Experimental Stimulation of the Cerebellum, Brain **49**:557, 1926.

were sunk deeper and deeper into the organ and made to approximate the nuclei of the roof and the nucleus dentatus, becoming maximal on stimulation of these structures.

Clarke, however, attributed this effect to the spread of the currents to the paracerebellar nuclei of the pons, the well known relay station for the vestibulo-ocular reflexes of the vestibular apparatus. Other structures that were thought to be responsible for the deviation of the eyes in lesions of the cerebellum, especially when these occurred in man, were the posterior longitudinal bundle and the nucleus of the sixth nerve, structures which ever since Foville described his well known syndrome (conjugate deviation of the eyes to the side opposite the lesion with contralateral hemiplegia) have been accepted as the nuclear center and its pathway for this composite movement. In any event, the phenomenon has not been regarded as directly cerebellar in origin (Gordon Holmes[14]). This opinion is not borne out by my observations in the seven cases of cerebellar abscess referred to in the early part of this paper. Deviation of the eyes to the side opposite the lesion was present in greater or less degree in any one of these cases, in five cases in the absence of any phenomena that might have indicated damage to the pontile nerves, and in one other case in the absence also of nystagmus, a condition which I believe to be inconceivable in the presence of an involvement of the nucleus of the sixth nerve, the paracerebellar nuclei or of the posterior longitudinal bundle. The phenomenon was, furthermore, present regardless of whether the abscess, small in size and well circumscribed, was situated in the superior part of the cerebellum, close to the tentorium or in its inferior part near the angle. It appears, therefore, that the deviation of the eyes in lesions of the cerebellum is not a remote phenomenon but is due to the involvement of the cerebellum itself. The deviation of the eyes in lesions of this organ, in contradiction to that resulting from a lesion of the cerebrum, is not toward the side of the lesion but toward the side opposite it; i. e., whereas a lesion of the cerebrum abolishes the power to move the eyes to the opposite side, a lesion of the cerebellum abolishes the power to move them to the same side, which is in conformity with the fact that the cerebrum exhibits its effect contralaterally whereas the cerebellum exhibits its effect homolaterally.

The conjugate deviation of the eyes in lesions of the cerebellum, more specifically, the direction toward which the eyes are deviated, is, as is shown by my cases, totally independent of the direction of the nystagmus with which the phenomenon, as is most generally the case, is associated. The deviation of the eyes, while of varying extent, is always to the side opposite the lesion, and their position, at rest, is on

14. Holmes, Gordon: Palsies of the Conjugate Ocular Movements, Brit. J. Ophth. **5**:243 (June) 1921.

the other side of the midline. The nystagmus, on the other hand, i. e., the quick phase of it, is either to the side opposite the lesion, which is due to involvement of the labyrinth and abolition of its function on the affected side, or to the side of the lesion if the labyrinth is functioning. In the latter instance, the nystagmus would be produced either by irritation of the homolateral labyrinth, or, as is more likely, by the lesion of the cerebellum that is damaging the fiber tracts, which, being derived from the contralateral labyrinth, terminate in it. The nystagmus to the side of the lesion, then, replaces the nystagmus to the opposite side, which precedes it and which, being purely labyrinthine in origin, becomes compensated quickly. However, the direction of the nystagmus seems to determine the degree to which the eyes are deviated, as shown by the greater deviation of the eyes in the case of nystagmus to the opposite side than in the case of nystagmus to the same side as the lesion.

The deviation of the eyes in abscess of the cerebellum is also independent of the position of the head. In my cases the position of the latter was invariably the same as the direction of the nystagmus. The explanation is probably to be found in the fact that in experiencing the sensation of being propelled in the direction of the quick component, the sensation which expresses itself motorially in the phenomenon of nystagmus (it is assumed here that vestibular nystagmus, like optic or "railroad" nystagmus, has its origin in a sensation, which in the case of the vestibular type is more or less subconscious, of rapidly moving on to the right or the left, depending on which labyrinth is affected, and passing stationary objects in his field of vision), the patient, as in the case of a normal person when his labyrinth is stimulated directly, in order to determine his relationship to the surrounding world, fixates with his eyes an object directly in front of him and maintains this fixation in order to maintain his relationship to the surroundings in status quo, giving rise in this manner to the primary and essential motor phase of the nystagmus, the so-called slow phase. Finally, in accordance with his erroneous sensation of movement, the object fixated passes out from his field of vision; in order to determine anew his relationship to the world about him, by a rapid movement of the eyes, the so-called rapid phase of the nystagmus, he fixates an object, which at this moment enters his field of vision from the other side. He then maintains his fixation of the new object, and the cycle is repeated.

So experience taught the patient that the fixation of an object combined with the retention of the fixation during the primary phase of the nystagmus is carried out by a movement of the eyes which is specific in range. This movement of the eyes occurs when they are conjugately deviated or interfered with. Owing to the deviation of the eyes, the patient cannot, of course, carry out with ease the primary, the slow, phase of the nystagmus if the nystagmus is toward the side opposite

the lesion. He can execute this movement in the case of nystagmus toward the side of the lesion, but the range of the movement, the accustomed amplitude of it, is then diminished, and he compensates for it by turning his head in the direction of the quick component, his eyes at the same time fixating the object which is gradually passing from his field of vision.

CASE 3.—*Small, circumscribed abscess within the lobulus quadrangularis of the left hemisphere of the cerebellum, close to the tentorium. Conjugate deviation of the eyes to the right, nystagmus, horizontal in type and small in amplitude to the right; head in midline.*

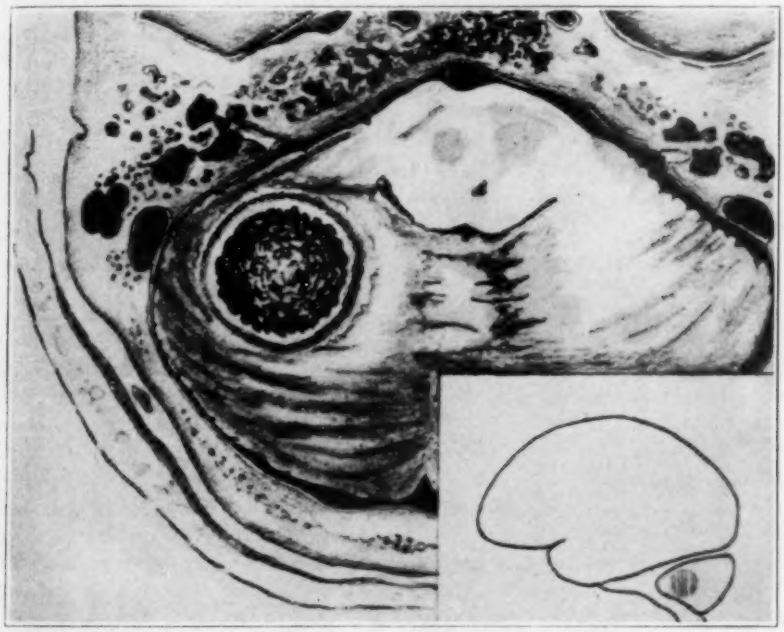


Fig. 6 (case 3).—Abscess in the superior part of the cerebellum on the left side.

F. B., a man, aged 60, a private patient, was seen in consultation with Dr. Melville L. Loomis and Dr. P. S. Newmark on Feb. 21, 1929. He had had acute otitis media with mastoiditis on the left side on Jan. 22, 1929. Mastoidectomy had been performed a few days later. The patient apparently recovered, and on the tenth day following the operation was about to go home when he began to suffer from headache. The headache became more severe, and a few days later nystagmus developed, which was horizontal and rotary in type and extraordinarily severe when he was looking to the left. At that time the temperature was 102 F.; the blood contained 21,000 leukocytes. The temperature dropped, but remained somewhat elevated; it was never subnormal. On February 17, the blood contained

8,000 leukocytes, and a few days later, 14,000. The patient vomited. The urine contained albumin and casts. Chemical analysis of the blood showed the nonprotein nitrogen to be 110. He was treated for uremia.

Examination.—When examined by me on February 21, the observations were as follows: The patient was stuporous and after some delay responded to such commands as "show your tongue, etc." The left upper eyelid was edematous and in partial ptosis; he could, however, elevate the lid. The pupils were equal, small and regular and reacted to light. He had a definite, though not marked, conjugate deviation of the eyes to the right. He showed a nystagmus of small range on looking to the right, but none on looking to the left. The right arm and leg were distinctly weaker than those on the left. There was a Babinski sign on the two sides. The deep reflexes were increased; there was no clonus. The abdominal reflexes were not obtained. The disks were blurred on the nasal side, more so on the left. Hearing was almost lost on the left side; it was fair on the right side. There was cervical rigidity, but no Kernig sign. The patient was able to comprehend. On that day the blood contained 14,000 leukocytes. The blood pressure was 180 systolic and 140 diastolic. Chemical analysis of the blood showed the nonprotein nitrogen to be 50. The spinal fluid was clear, under 350 mg. of pressure; the amount of globulin was increased; the spinal fluid had a cell count of 20. The temperature was 99.8 F.; the pulse rate, 68.

Diagnosis.—The diagnosis was abscess of the left hemisphere of the cerebellum.

Operation.—The patient was operated on a few hours later. An abscess was found in the location indicated in figure 6, and drained. The patient died on February 23; necropsy was not permitted.

CASE 4.—*Arachnoid cyst, secondary to acute otitis media in the inferior part of the right hemisphere of the cerebrum with much destruction of cerebellar tissue, chiefly in the region of the digastric lobule (fig. 8), in a child, aged 1 year. Conjugate deviation of the eyes to the left, horizontal nystagmus to the left, none to the right; extreme deviation of the head (fig. 7) to the left.*

E. M., aged 1 year, a Mexican, was admitted to the hospital on Oct. 14, 1929, as having a case of spastic paraplegia, and was assigned to the pediatric service. The child ran a high temperature for some days, and underwent a double myringotomy which resulted in free drainage of purulent material, more marked from the right side. He continued to be sick, and marked cervical rigidity developed. Mastoidectomy was performed on the right side on November 17.

Examination.—On November 20, neurologic examination revealed: The temperature was 100.6 F.; it was never subnormal. The patient was quiet, unless disturbed. He had marked cervical rigidity, but no Kernig sign. The eyes moved freely in all directions, but were generally deviated to the left. There was horizontal nystagmus of large amplitude to the left. The head was in extreme deviation to the left. He showed weakness of the right arm and leg. There was an inconstant Babinski sign on the right, and a normal plantar reflex on the left. The disks were clear on the two sides.

Diagnosis.—The diagnosis was involvement of the cerebellum on the right. Exploration was advised.

Operation.—On November 25, operation disclosed a circumscribed arachnoid serous cyst secondary to localized meningitis, with much destruction of the cerebellar tissue on the inferior part of the cerebellar hemisphere on the right side. This involvement was also confirmed by necropsy.

Fig. 7 (case 4).—Appearance of patient, showing conjugate deviation of the head and eyes to the left.

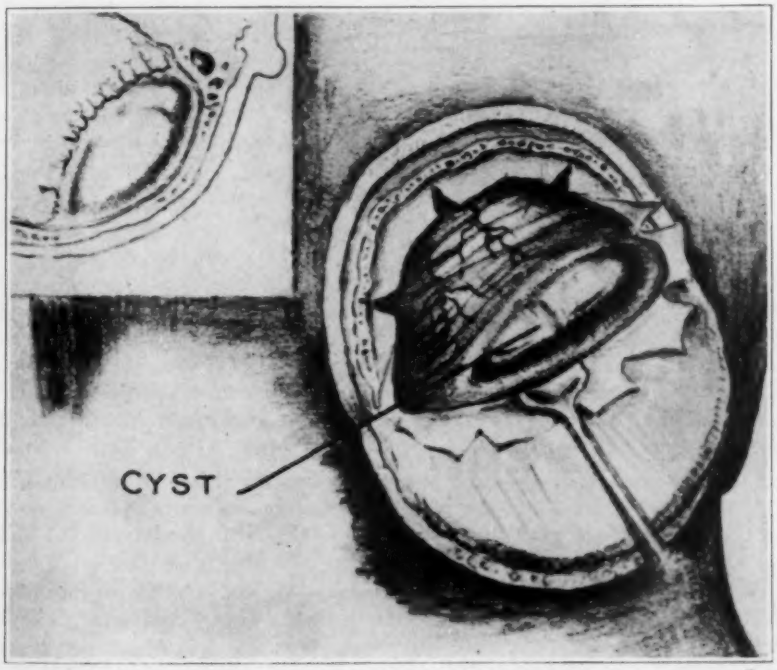


Fig. 8 (case 4).—Location of the arachnoid cyst, with destruction of the cerebellar tissue in the inferior part of the right hemisphere of the cerebellum.

CASE 5.—*Large abscess of the right hemisphere of the cerebellum. When examined for the first time, the patient was in deep stupor. Pronounced conjugate deviation of the eyes to the left; head deviated to the left; practically no nystagmus.*

C. T., a man, aged 46, was admitted to the hospital on Dec. 30, 1927, with myocarditis and chronic otitis media. There had been a discharge from the right ear for the last four years. There was an acute exacerbation two months before examination, when headache developed, and he became drowsy.

Examination.—On the day following admission, neurologic examination revealed: The patient was in a state of deep stupor. The pupils were small and reacted slightly. He had a pronounced conjugate deviation of the eyes to the left. The head was turned to the extreme left. There was practically no nystagmus. There was a Babinski sign on both sides, more marked on the left. The fundi showed an elevation of about 2 diopters. The temperature was subnormal; the pulse rate, 60. The blood contained 16,700 leukocytes; the spinal fluid was clear and under greatly increased tension; it contained some globulin, 396 cells and a normal sugar content. The patient appeared to be sinking rapidly.

Diagnosis.—The diagnostic impression was abscess of the cerebellum on the right side.

Operation.—The patient was operated on a few hours later, and died the same day.

Necropsy.—The postmortem report was as follows: Within the right cerebellar hemisphere was a circumscribed abscess 2.5 cm. in diameter, containing foul-smelling, thick, yellowish-green, purulent material. The wall of the abscess was lined with a thick, pyogenic membrane averaging 3 mm. in thickness. The abscess was situated near the surface of the cerebellum, where the hemisphere lay in apposition to the posterior surface of the petrous portion of the temporal bone. There was a chronic otitis media with destruction of the ossicles, necrosis of the drum and extension into the semicircular canals and cochlea. The latter was completely destroyed, but no direct communication could be demonstrated between this opening and the abscess in the cerebellum.

CASE 6.—*Small abscess not yet encapsulated in the region of the tonsil of the right cerebellar hemisphere (fig. 9). Conjugate deviation of the eyes to the left, nystagmus to the right and deviation of the head to the right.*

C. A., aged 5, was admitted to the hospital on April 9, 1930, with otitis media. He had always been well. He had had a severe headache on both sides about a month before examination and a few days later a discharge began from the ears. The earache and discharge continued. A week before admission, the patient began to suffer from severe headache again and occasional vomiting, and a few days later he became listless and drowsy. The temperature was generally subnormal, and the pulse rate ranged from 60 to 90.

Examination.—On April 14, the blood contained 11,250 leukocytes, with 77 per cent polymorphonuclears. Examination of the spinal fluid was repeated several times, but as the fluid was blood-tinged the results were unreliable. The spinal fluid was not under increased pressure.

Roentgenograms of the skull and the mastoid showed no destruction of bone.

On April 15, neurologic examination revealed: The patient was lying with his head turned to the right. He had marked horizontal nystagmus on looking to the right, less marked when the eyes were in the midline and practically none on looking to the left. The ocular movements were carried out in all directions, but he showed a tendency to look to the left. There were no palsies of the cranial

nerves. The deep reflexes were hyperactive on the left side. There was no Babinski sign, and no clonus on either side. The right hand appeared ataxic. The child was intelligent and tried to cooperate in the examination, but he suffered from extreme headache. The fundi showed no elevation; the margins were distinct, with the exception of the right nasal half, which was somewhat blurred.

A neuro-otologic examination was made. The patient was recumbent. On stimulation of the left horizontal canal with cold water, the eyes, after about twenty-five seconds, became deviated strongly to the left, and persisted in their deviation, showing no quick phase to the other side. A horizontal nystagmus, of

Fig. 9 (case 6).—The cerebellum, showing infiltration and swelling of the right hemisphere, and location of the small abscess in that hemisphere.

large range, to the other side set in as soon as the patient fixated an object straight ahead. On setting the patient upright with his head 30 degrees forward, there was a good rotatory nystagmus to the right, provided, however, the patient, as in the case of stimulation of the horizontal canal, fixated an object in front of him, the eyes turning to the left as soon as he ceased fixating the object. He showed no systemic response (pallor, sweating, etc.). On stimulation of the right ear with cold water, there was a normal response after thirty seconds of irrigation from both the horizontal and the vertical canals. However, there was no systemic response. Owing to the poor cooperation of the patient, past-pointing could not be tested.

Diagnosis.—The diagnosis was cerebellar abscess on the right side.

Operation.—The patient was operated on on April 16, and pus, too thick to flow through the needle, oozed freely through a drainage tube. There was a free purulent discharge from the wound, and the next few days the patient was much improved, but on April 20, he suddenly began to show evidence of collapse, and died a few hours later.

Necropsy.—Postmortem examination (April 21) showed the right cerebellar hemisphere to be soft and much larger than the left. There was a small abscess with free pus which did not have a formed capsule in the region of the tonsil of that hemisphere (fig. 9).

CASE 7.—*Abscess of the left hemisphere of the cerebellum in a woman, aged 24. Right eye was deviated to the right; the left eye, owing to paralysis of the internal rectus muscle, was in the midline. Head tended to deviate to the left, offering resistance when it was passively turned to the right. No nystagmus.*

D. D. C., a Mexican woman, aged 24, was admitted to the hospital on March 31, 1930, with mastoiditis of the left side. She had had a purulent discharge from the left ear for the last three months. Operation had been performed on the left mastoid on Feb. 18, 1930. Headache had persisted since the operation, and had become especially severe a week before admission.

Examination.—On April 2, the blood contained 13,500 leukocytes, with 82 per cent polymorphonuclears. The temperature was 99.4 F.; the pulse rate, 68. The spinal fluid was under greatly increased tension, with a cell count of 70 lymphocytes; there was no globulin, and the sugar content was normal.

Neurologic examination (April 2, about 8 p. m.) revealed the patient in a state of stupor (it was recorded by one of the staff who examined her about twelve hours before that the patient was suffering from aphasia). The pupils were moderately dilated, a little more on the right side. They reacted to light. The corneal reflex was present on both sides. There was an old peripheral facial paralysis on the left. The palate reflex was present. There was no nystagmus. The right eye was deviated to the right; the left eye was at the midline. There was partial ptosis of the left upper eyelid. The head tended to deviate to the left and offered resistance when it was passively turned to the right. The deep reflexes in the arms were normal; those in the legs were spastic, more so on the left side. Ankle clonus and a Babinski sign were present on both sides, more marked on the left. There was marked cervical rigidity. The disks were blurred on the nasal side. Whether or not she had aphasia could not be determined in her present state. Cold caloric stimulation of the right ear (patient was recumbent) gave rise, after thirty seconds, to a pronounced conjugate deviation of both eyes to the right, which persisted for about three or four minutes. There was no nystagmus. The patient was too sick to have the neuro-otologic tests continued.

Diagnosis.—The diagnostic impression was abscess of the left temporal lobe.

I based this diagnosis on the history of aphasia and on my assumption that the position of the eyes was due to a partial, bilateral paralysis of the oculomotor nerve which affected the internal rectus on the right side and the internal rectus as well as the levator palpebrae superioris on the left side. It is well known that tumors and abscesses of the temporal lobe are prone to give rise to palsies of the ocular nerves. I failed to recognize that the deviation of the right eye represented a conjugate deviation of the eyes to the right, as shown by the persistence of the eyes in conjugate deviation to the right on stimulation of the right labyrinth with

cold water, the left eye having failed to turn in spontaneously because of the paralysis of the oculomotor nerve on that side.

Operation.—The patient was operated on on April 3. The left temporal lobe was explored, and no abscess was found. Following this a suboccipital exposure was made, and an abscess was found within the left cerebellar hemisphere. The patient died on April 6. Necropsy was not permitted.

CASE 8.—*Abscess of the cerebellum on the right side in a woman, aged 25. Conjugate deviation of the eyes to the left. No deviation of the head; very slight nystagmus to the right, none to the left.*

M. N., aged 25, was admitted to the hospital on April 28, 1930. She had had bilateral otitis media at the age of 3 years. The purulent discharge had persisted. Mastoidectomy had been performed on the left side two months before admission. She made a good recovery, but six weeks later severe headache and backache developed. These pains persisted and increased in severity. She had had to stay in bed during the last four days, and had vomited repeatedly.

Examination.—On neurologic examination (a few hours after admission) the pupils were found to be dilated (homatropine); there was a conjugate deviation of the eyes to the left, just beyond the midline. She was able to move the eyes to the right. The head showed no deviation to either side. There was a very slight nystagmus when the patient looked to the right, and none when she looked to the left. There was a peripheral facial paralysis on the right. Hearing was impaired on both sides, both by bone and air conduction. The right fifth nerve was less sensitive than the left. There was no paralysis of the palate or the pharynx. The reflexes were increased bilaterally, with slight clonus. There was no Babinski sign; the abdominal reflexes were lost. There was some ataxia on the right hand. There was no hemianopia or astereognosis. The disks were elevated about 2 diopters on both sides. The patient was screaming from headache and could not be tested for past-pointing, the Romberg sign or disturbances of gait. She had cervical rigidity, but no Kernig sign. The temperature was 97.8 F.; the pulse rate, 56; the respiratory rate, 18. The spinal fluid was clear, and under greatly increased pressure; it contained 10 cells (lymphocytes) and no globulin, and the amount of sugar was much reduced. The blood contained 8,330 leukocytes, with 83 per cent polymorphonuclears.

A neuro-otologic examination was made. The patient was recumbent. Cold caloric stimulation of the left ear gave rise after fifteen seconds to an intense conjugate deviation of the eyes to the left with occasional small twitches to the right. The deviation persisted for about two minutes. There was no constitutional response. Cold caloric stimulation of the right ear produced a prompt nystagmus (in about twenty-five seconds) to the left. The nystagmus was of small range and horizontal, and lasted about a minute. Owing to the patient's resistance, the vertical canals were not tested.

Diagnosis.—The diagnosis was cerebellar abscess on the right side.

Operation.—The patient was operated on a few hours later. The abscess was found and drained. She made an uneventful recovery.

CASE 9.—*As evidenced by the clinical phenomena, there was an inflammatory, serous process of the right hemisphere of the cerebellum which subsided before going on to suppuration. Symptoms cleared up gradually, and the patient recovered without an operation.*

J. L., a girl, aged 5 years, was admitted to the hospital on July 19, 1928. She had had an earache on the right side during an attack of chickenpox. The ear had been incised repeatedly, because the infection did not clear up. Operation

had been performed on the right mastoid on June 21, 1928, and about a week later severe headache developed.

Examination.—On July 21, neurologic examination revealed: an alert child, not toxic and of good intelligence. The pupils were dilated; the right was distinctly wider than the left. She showed a tendency to conjugate deviation of the eyes to the left. The head was deviated to the right, and there was a marked horizontal nystagmus and a slight vertical nystagmus to that side. There was definite weakness of the left side of the face and the left arm and leg, with increased reflexes on that side. There was hyperemia of the disks. Hearing was present in the two ears. Owing to the child's alertness and the absence of toxic symptoms, it was thought best to advise no further treatment, but to have her under observation. On July 23, reexamination showed the pupils practically equal, and reacting to light and in convergence. There was no conjugate deviation of the eyes. The head was still turned to the right. Horizontal nystagmus on looking to the right persisted, and was of moderate range. There was no vertical nystagmus. There was marked ataxia of the arm and the leg on the right side. On standing, the patient tended to fall to the right. She tended to past-point spontaneously to the right. The reflexes were but slightly exaggerated, and were equal on the two sides. There was no Babinski sign on either side. The abdominal reflexes were present. The palate reflex was normal. There was no dysarthria. Hearing in the right ear was fair; that in the left ear was good by both air and bone conduction. The Weber test was lateralized to the left. Stimulation of the left labyrinth with cold water brought forth a normal response (the nystagmus and past-pointing) from both the horizontal and the vertical canals. The constitutional response was subnormal. The patient was fairly cheerful and mentally clear. It was thought best to keep her under observation. She continued to improve and was discharged on August 27 as having recovered. She then showed no gross abnormalities, and aside from slight ataxia suffered no discomfort. Such a fortunate termination is not, however, always to be expected, as even in the early state, before progression to suppuration and gross destruction of the tissue, an inflammatory process of the organ may cause the death of the patient through the edema and pressure paralysis of the medullary nerves. This is shown by the following case.

Case 10.—R. W., a man, aged 52, an American, was admitted to the hospital on March 17, 1930. He was assigned to the eye, ear, nose and throat service. He stated that he had suffered from otitis media and deafness on the right side for the last fifteen years, and that a few weeks before admission he had begun to have headaches on the right side, and "paralysis" had developed on that side. The symptoms had been growing worse.

Examination.—On the day of admission, the results of examination by an intern were reported as follows: The patient was well developed physically. The circulatory and respiratory systems showed nothing abnormal. The pupils were regular and reacted to light and in accommodation. The ocular movements were normal. All of the tendon reflexes were hyperactive. There were no pathologic reflexes. He showed no lack of muscular coordination, but in walking tended to deviate slightly to the right. The blood count showed 13,300 leukocytes, of which 68 per cent were polymorphonuclear cells and 32 per cent lymphocytes. There was a purulent discharge from the right ear. On March 19, a note from Dr. Dettling, of the eye, ear, nose and throat service, stated that the patient was totally deaf on the right side. He showed muscular incoordination on that side, with asynergia and adiadokokinesis. He could not stand, and tended to fall backward.

On March 24, neuro-otologic examination (by Dr. Isaac H. Jones) showed spontaneous horizontal nystagmus on looking to the right, none on looking to the left. There was vertical nystagmus on looking up, none on looking down. The patient tended to fall to the left regardless of the position of the head. Douching of the right ear with water at 68 F. gave no response from either the vertical or the horizontal canal, although the irrigation was continued for five minutes. There was no constitutional response. Douching of the left ear with water at 68 F. gave no response when the vertical canal was stimulated, but produced a nystagmus of large amplitude but oblique in direction when the stimulation was applied to the horizontal canal. There was no constitutional response. On douching of the right ear the patient past-pointed with the right hand about 14 inches (35.48 cm.) to the left and touched with the left hand. On douching of the left ear, he past-pointed with the right hand about 12 inches (30.48 cm.) and touched with the left hand.

Fig. 10 (case 10).—Appearance of patient, showing the so-called "cerebellar attitude of the head." (Note: In this attitude the face is turned to the side and the chin is tilted up, whereas the occiput, which is turned to the other side, is depressed approximating the other shoulder. The position of the head thus corresponds to the position of the eyes in "skew" deviation, noted now and then after lesions of the eighth nerve and of the cerebellum, a position of the eyes that appears to represent the slow component of a composite nystagmus, of a nystagmus both in the horizontal and in the vertical plane.)

On neurologic examination on March 29, the patient was fully conscious and cooperated. The pupils were small and unequal; the left was wider than the right; both reacted poorly to light and in accommodation. The eyes were deviated to the left, but he could move them to the right. He had a peripheral, complete paralysis of the right seventh nerve. There was a wide palpebral fissure on the right, with conjunctivitis. Hearing on the right was lost for both air and bone conduction. He had a paralysis of the soft palate with nasal speech and a partial paralysis of the muscles of the pharynx with dysphagia. He also suffered from dyspnea and considerable aphonia, from involvement of the fibers of the laryngeal recurrent branch of the tenth nerve. The deep reflexes were greatly increased, more

so on the left side. There was no clonus. There were no sensory disturbances. The head was practically always turned to the right (the chin to the right and up, the occiput to the left shoulder and down, fig. 10). The patient was extremely ataxic in the arms and the legs. He walked only a few steps, when he tended to fall, usually to the left. He past-pointed spontaneously, generally to the right,

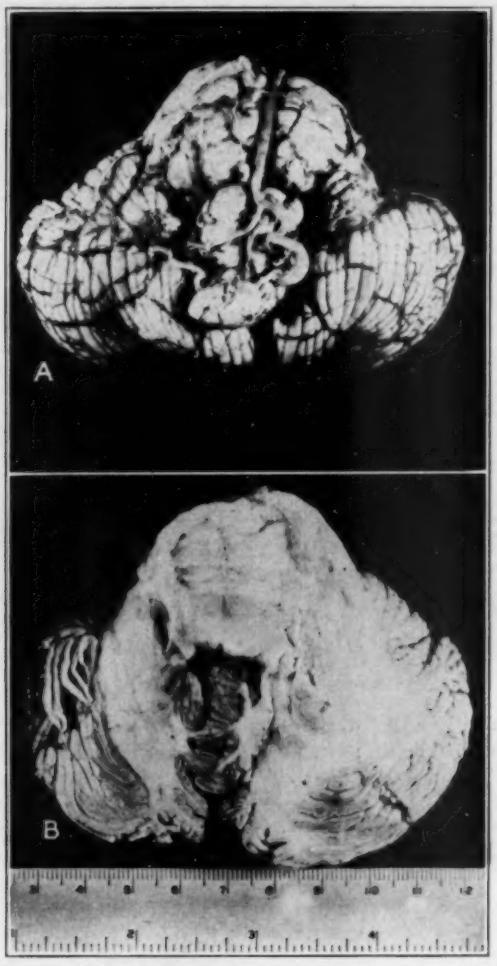


Fig. 11 (case 10).—The cerebellum. Note the large size of the inflamed right hemisphere as compared with that of the comparatively uninvolved left hemisphere. *A* shows the inferior or basal surface of the cerebellum; *B*, the transverse section of the cerebellum, the superior surface of the inferior portion.

occasionally to the left. He had a pronounced horizontal nystagmus on looking to the right, none on looking straight ahead and one that was very faint on looking to the left. The fundi were clear; the margins were distinct, but the right appeared congested as compared with the left. The Wassermann reactions of the

blood and the spinal fluid were negative. The fluid was under increased pressure; it contained from 1 to 2 cells per cubic millimeter, no globulin and a normal amount of sugar.

Diagnosis.—The diagnostic impression was circumscribed meningitis at the cerebellopontile angle on the right side.

Operation.—The patient was operated on on April 3. He died the same day.

Necropsy.—Postmortem examination showed the inflammatory process to involve chiefly the right hemisphere of the cerebellum. This part of the organ was greatly enlarged from the edema and round cell (also partly polymorphonuclear cell) infiltration, as compared with the left hemisphere (fig. 11). The inflammatory process resulted in the death of the patient through pressure paralysis of the medullary nerves.

Fig. 12 (case 10).—Photomicrograph of a section from the right half of the cerebellum, showing the infiltration by round cells and polymorphonuclear cells. Hematoxylin and eosin stain; × 95.

The following case of abscess of the right hemisphere of the cerebellum came under my observation recently.

Case 11.—F. C., a boy, aged 5 years, was admitted to the department for contagious diseases of the hospital on Dec. 27, 1930, with chickenpox and bilateral otitis media. A discharge from the ears was reported to have developed about a month before admission to the hospital. He contracted chickenpox a few days before admission, simultaneously with which the discharge from the right ear became profuse, and he began to suffer from severe headaches and vomiting. During the first week in the hospital, his temperature aranged from 100 to 101.6 F., and a simple mastoidectomy was performed on the right side on Jan. 4, 1931. During the week following, his temperature ranged from 101 to 103 F. It became subnormal (98.4 F.) on January 12, and the pulse rate dropped to 68.

Fig. 13 (case 11).—Appearance of patient, showing conjugate deviation of the head and the eyes to the left.

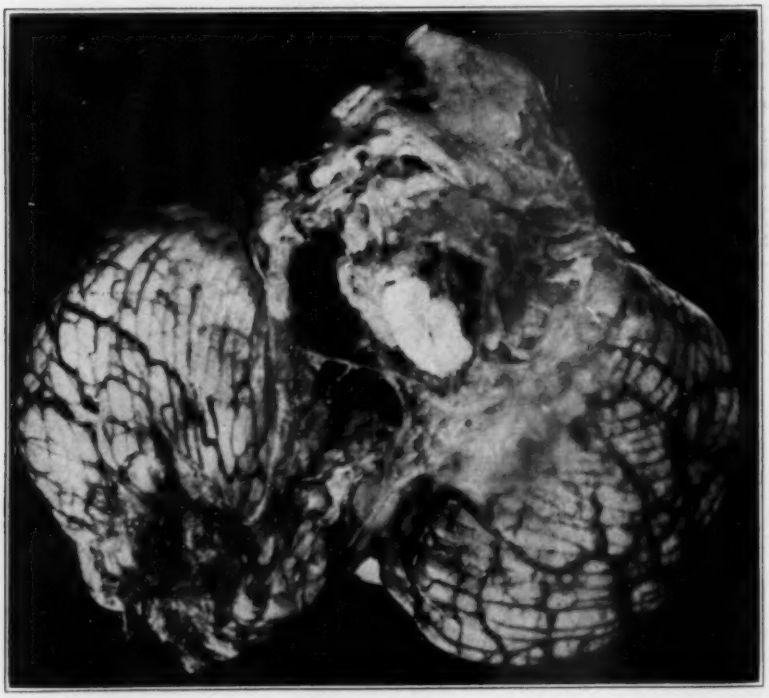


Fig. 14 (case 11).—The cerebellum, showing the location of the abscess in the right hemisphere.

Examination.—I saw the patient for the first time on that date, and examination revealed these changes: The patient was stuporous, but cried out in pain whenever his head was subjected to movement. The pupils were dilated and reacted fairly well to light. The eyes were in extreme conjugate deviation to the left, and the head showed a tendency to deviate to the same side (fig. 13). There were slight, occasional, nystagmoid jerks to the left. There was marked hypersensitiveness in the region of the right trifacial nerve. The reflexes in the arms were normal, but those in the legs were spastic. There were bilateral ankle clonus and Babinski signs, somewhat more pronounced on the left side. The abdominal reflexes were present on both sides. There was a slight Kernig sign. The fundi showed no elevation, but the vessels were full and tortuous. Owing to a lack of cooperation, the patient could not be examined for disturbances of speech, astereognosis, agnosia, etc. The spinal fluid was reported to be clear, under normal pressure, with a cell count of 27.

Diagnosis.—The diagnosis was abscess of the cerebellum on the right side. The case was differentiated from an abscess of the parietal lobe on the left side, with conjugate deviation of the head and eyes toward the side of the lesion, by the absence of spasticity with a tendency to contractures on the right side, observations that would be present in the latter type of lesion; also by the fact that the patient showed definite hyperesthesia in the region of the trifacial nerve on the right side.

Operation.—The patient was operated on on the following day, and an abscess containing thick, tenacious pus was found within the substance of the right lobe of the cerebellum (fig. 14). This was evacuated and drained. The patient made satisfactory progress for a time, but finally basal meningitis developed, and he died on February 24.

SUMMARY

1. In abscess of the cerebrum conjugate deviation of the head and eyes is extreme when the lesion affects the angular gyrus of the parietal lobe; it is of moderate extent if the lesion affects the posterior part of the frontal lobe close to the rolandic region. It is absent, no matter how extensive the lesion, in abscess of the prefrontal region of the frontal lobe, in abscess of the occipital lobe and in abscess of the temporal lobe. The deviation in cerebral lesions, when present, is toward the side of the lesion. Interpreting the movement as an attitude of attention and assuming the angular gyrus to be the center of psychic vision (i. e., the interpretation of visual stimuli), as shown by the fact that lesions of this region on the left side give rise to alexia or agnosia, the inability to understand writing or to recognize objects by vision, I conclude that attention is dominated most powerfully by stimuli arising within the sphere of vision and relatively little by other kinds of stimuli.

2. Conjugate deviation of the eyes, regardless of the position of the head, is an invariable accompaniment of an abscess of the cerebellum. The deviation, varying in extent, in this type of case is in a direction opposite the lesion. It manifests itself most clearly as a persistent deviation of the eyes to the side opposite the lesion on cold caloric stimulation of the labyrinth on that side, the deviation interfering with

or greatly delaying the development of the rapid phase of the nystagmus. The phenomenon is undoubtedly due to involvement of the cerebellum itself, and not to an involvement of structures at a distance.

3. In abscess of the cerebellum the nystagmus is toward the side opposite the lesion, when the labyrinth on the side of the lesion is destroyed. It is toward the side of the lesion when the labyrinth is functioning. It may then be due to irritation of the labyrinth or to deficiency of the cerebellum.

4. Nystagmus may be slight or even absent in abscess of the cerebellum.

5. The deviation of the head that is frequently observed in abscess of the cerebellum corresponds in direction to that of the quick component of the nystagmus. It is suggested that the deviation of the head is a compensatory phenomenon intended to replace in part the movement of the eyes that is to occur during the slow component of the nystagmus, a movement which, as explained, becomes restricted in range, owing to the deviation of the eyes brought about by the lesion of the cerebellum.

Dr. Cyril B. Courville, resident neurologist at the hospital, was present at most of the operations recorded in this communication; he prepared the illustrations shown in figures 6 and 8.

CHOLESTEATOMA

SOME NEW PRINCIPLES IN ITS TREATMENT, INCLUDING THE TEST FOR ITS CHEMICAL DEMONSTRATION *

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Otologists are familiar with the important rôle played by cholesteatoma as a complication in suppuration of the middle ear. Examination of the pus with the naked eye usually gives a sufficient basis for suspecting cholesteatoma. In addition, the various-sized masses revealed by irrigation with the attic cannula strengthen the diagnosis. The detection of typical cholesterol crystals under the microscope gives positive evidence of cholesteatoma. Unfortunately, these crystals are lacking in many cases. Their absence, therefore, does not exclude the possibility of cholesteatoma. Recently, efforts have been made to determine the presence of cholesteatoma by roentgen examination, but results in general are uncertain, although occasionally the pictures show the size and location of the mass.

Johannes Müller first called attention to the presence of cholesterol in the tumors made up of desquamating epithelium in chronic suppurative otitis media, and he therefore named these masses cholesteatoma. Virchow opposed this nomenclature. In his opinion, cholesterol is not peculiar to these pathologic masses, since it is found in many other parts of the body. Virchow named these desquamated epithelial masses pearl tumors (Perlgeschwulst) because of their luminosity. Among the earlier investigators, Lucae pointed out that the cholesterol content of these epithelial masses is exceedingly varied and inconstant.

More detailed data concerning the cholesterol content of cholesteatoma have been brought out by a chemist, Geheimrat Salkowski, who occupied himself with this problem, following the lead of Docent Haike. These investigations brought out that, although there is always cholesterol in the cholesteatoma, it is not always in crystalline form but often in an amorphous state, especially cholesterol-ester. This waxlike mass agglutinates with the layers of the epithelial tumor.

Crystalline cholesterol is an alcohol of high valence. Its formula is $C_{27}H_{45}OH$. The amorphous cholesterol is its ester. According to Salkowski's investigations, the esters of oleic acid are present frequently

* Submitted for publication, Nov. 13, 1930.

* Based on a paper read at a session of the Collegium Oto-Rhino-Laryngologicum, Frankfurt, Germany, Sept. 12, 1930.

and are to be found not only in the amorphous state but also in groups of crystals, like small needles. During my own investigations I also observed them, in their native condition as well as in preparations dissolved in chloroform and evaporated.

Lautenschlager demonstrated that the agent that destroys the bone is the chemical effect of cholesterol and not the mechanical pressure of the tumor, as was formerly believed. If one accepts Lautenschlager's seemingly plausible opinion as to this action of cholesterol, one must believe the same about the esters of cholesterol, because the esters of the alcohols of high valence generally have qualities similar to those of the corresponding alcohols.

Virchow was correct in that many parts of the organism contain cholesterol, but in none of these tissues is there as plentiful an amount as in cholesteatoma. It is found more abundantly in the white substance of the brain, in bile, blood, sperm and, among pathologic secretions, pus.

According to Salkowski's estimate, there is 10.6 per cent cholesterol, that is, cholesterol-ester, in the normal epidermis, and from 18 to 23 per cent in cholesteatoma of the middle ear. The content of cholesterol found in the normal epidermis may be doubled in pathologic conditions.

What are the causes and conditions that produce this variation? In 1907, Haike presented as an unsolved problem the question as to why epidermis sometimes migrates into the tympanic cavity and becomes a matrix and, at other times, apparently under the same conditions, it becomes a cutaneous cover stimulating the healing, as after a radical operation. Owing to the data from experimental biology and artificial implantations of tissue, the problem propounded by Haike is now solved. As is known, epidermis normally grows in dry surroundings, that is, in contact with air, but it becomes degenerated and changes to matrix in the presence of moisture, when air is absent and in a dark place. In the cavity produced by a radical mastoid operation, the epithelium grows if the space is filled with air and is dry, but when these conditions are not present, the production of cholesteatoma sets in.

One should utilize this biologic experience in clearing up cholesteatoma complicating suppuration of the middle ear. It is my conviction that one must strive, first, to keep out all moisture from the diseased ear by drying it in every way and getting sufficient oxygen into its cavity.

About a year before the present writing, I observed directly the noxious effect of aqueous treatment when I performed operations for large, swollen cholesteatomatous masses destroying the bone in patients who had had continuous medical attendance previously. In all instances I found a history of frequent aqueous irrigations and the use of ear

drops (hydrogen peroxide). From this observation I concluded that aqueous treatment for cholesteatoma is injurious.[1]

In the treatment for cholesteatoma one must not be satisfied merely with omitting the obnoxious, aqueous therapy, but one should strive to destroy the structure of the cholesteatoma, to withdraw its noxious contents and, if possible, to remove the whole shrunken mass. The instillation of tepid absolute alcohol, heretofore used, does not meet all these requirements. I therefore looked for some substance capable not only of drying but of dissolving the harmful contents of the tumor, that is, the cholesterol, thus disturbing the lamellar structure of the cholesteatoma.

Chemistry teaches that cholesterol is easily soluble in chloroform, carbon tetrachloride, hot alcohol and olive oil. One cannot use the chloroform and the hot alcohol because of their corrosive action. I therefore had a choice between carbon tetrachloride and olive oil. I chose the former, because one can demonstrate the cholesterol in it, and because one can control its dissolving effect. It would have been more agreeable to use the olive oil, as it does not irritate the skin, but I was unable to control its dissolving action. I am planning, however, to test the use of olive oil for cholesteatoma.

Carbon tetrachloride is an inexpensive tar product, and its application does not cause discomfort, although some sensitive patients complain of its corrosive effect as they do of the action of absolute alcohol. When kept for a long time in the external auditory canal, it produces a superficial dermatitis in patients with a sensitive skin; if one applies it infrequently, however, and drains off the residual liquid, carefully drying the cavity with hot air and covering the skin with a mild ointment, it may be used without harmful effect.

I shall not report on its curative effect at this time, as the records at my disposal are too few to permit deductions. In almost every case of chronic suppuration of the middle ear I was able to demonstrate traces of the cholesterol in the fluid aspirated from the middle ear by irrigation; in this way I reached the conclusion that carbon tetrachloride is a suitable agent for extracting cholesterol from the cholesteatoma hidden in the middle ear.

CHEMICAL DEMONSTRATION OF CHOLESTEATOMA

As I was executing the control experiment, it occurred to me to demonstrate cholesteatoma chemically. After trying different procedures, I made use of the second part of Bloor's method for this purpose. This procedure serves to determine the cholesterol content of the blood,

1. Rejtö: Verhandl. d. Gesellsch. deutsch. Hals-, Nasen- u. Ohrenarzte, 1929, p. 452.

and as an aqueous solution is made, the material examined is evaporated. If no water gets into the middle ear, one can demonstrate cholesterol in the fatty substance of the pus without evaporation. For this reason, I omitted the first part of the procedure. My method was as follows:

By means of a Pravaz syringe with an attic tube attached, 2 cc. of carbon tetrachloride was injected through the perforation of the tympanic membrane into the middle ear; the patient, with his head tilted to one side, was placed on a table sufficiently high to keep the fluid in the ear for from ten to fifteen minutes. At the end of this time, under direct illumination, I reaspirated the fluid through the tube attached, and poured it into a test tube. The quantity obtained was 0.5 cc., and I added 2 cc. of carbon tetrachloride to it. After shaking the fluid moderately, I filtered it through a filter paper saturated with carbon tetrachloride into a calibrated test tube and collected enough to make 5 cc. To this I added 2 cc. of glacial acetic acid with 3 drops of concentrated sulphuric acid. After shaking the fluid, I put it in a dark place, and in ten or fifteen minutes the reaction was already visible. It appeared distinct in one and one-half hours.

The result of the reaction is that the fluid will have a green color that persists for several hours. After this, the liquid becomes yellow; it retains this color for several days and occasionally longer. The intensity of the green color is directly proportionate to its cholesterol content. One may verify this for himself by using different concentrates of cholesterol secured from the chemist. Solutions of from 1 to 2 per cent give an excessive reaction. The result obtained in suppurations of the middle ear corresponded to 1:1,000 and 1:2,000 and even greater dilutions.

In order to have a comparison for this quickly transient color and intensity, I looked for some green color, aqueous solutions of which could be kept in test tubes and used as a permanent color index. The color chosen was naphtolgrün B,[2] and the dilutions were 1:10,000, 1:20,000, 1:30,000 and 1:40,000. The first I designated reaction 1, the others, reactions 2, 3 and 4. The strongest solutions were marked 1 and 2, and the weaker 3 and 4, according to the color index to which they corresponded. Up to the present writing this reaction had been carried out in my department in twenty-five cases in which there was a suspicion of cholesteatoma. In twenty of these twenty-five cases an operation was performed, so that the results of the reaction could be compared with the observations made at operation. In six cases strong reactions were obtained: reaction 1 in one case and reaction 2 in five cases. A cholesteatoma was found in all six cases: cholesteatomatous masses in three cases and a matrix in three cases. In fourteen cases the reaction was weak. Here I did not find a cholesteatoma; there were only granulations. On the basis of this result, I venture the deduction

2. This is manufactured by the I. G. Farbenindustrie Aktien Gesellschaft, Leverkusen, am Rhein.

that a weak reaction is not characteristic of cholesteatoma, for it may be obtained in all pus, but the stronger reactions are proof that a cholesteatoma exists.

I am aware that my investigations, which were begun only a year before this writing, are still in the incipient phase, and that I am far from speaking of definite methods and results. Nevertheless, I am reporting my actual results, because I feel that one investigator will never be able to solve this problem. If my colleagues in otolaryngology will interest themselves in this work, considerable practical results may be obtained in a short time.

PRIMARY TRACHEOBRONCHIAL DIPHTHERIA*

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AND
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Definite respiratory obstruction without laryngeal symptoms is uncommon. When it occurs, one should bear in mind a possible primary diphtheria of the trachea or bronchi. In this paper we shall consider only this condition and not a diphtheria extending from the larynx downward, which is fairly common.

Lynah [1] was probably the first to call attention to a primary diphtheria of the tracheobronchial tree. In a convincing fashion and with an abundance of clinical material, he demonstrated by endoscopy and postmortem examination that the pathologic process may begin in either the trachea or the bronchi, and that it may extend up or down the respiratory tract. Our analysis of thirty-nine of his reported cases showed an absence of gross diphtheritic disease in the pharynx or larynx in eighteen.

Other contributions on the subject have been few. (Much has been written on laryngeal diphtheria and secondary extensions to the tracheobronchial tree. In a previous paper, one of us [Dr. Hart] [2] reviewed a large part of this literature with reference to intubation and tracheotomy.) A case reported by Smith [3] as one of primary diphtheria in the trachea or bronchi was incomplete because no direct laryngeal examination was reported. Lowder [4] reported a case of tracheal diphtheria, but in view of the aphonia it was probably an extension from the larynx. No direct laryngoscopic examination was reported. Dupuy [5] reported two cases of primary tracheobronchial diphtheria. One was in an adult with a normal larynx; the other, in an infant for whom no

* Submitted for publication, Nov. 26, 1930.
* From the Charlotte Eye, Ear and Throat Hospital.

1. Lynah, Henry Lowndes: Tracheobronchial Diphtheria, Laryngoscope **26**: 1193 (Oct.) 1916.

2. Hart, V. K.: Laryngeal Diphtheria: I. Proper Management of Intubated Cases; II. Relation of Tracheotomy to Intubation, Tr. M. Soc. State North Carolina, May, 1928, p. 482; Ann. Otol., Rhin. & Laryng. **39**:636 (June) 1930.

3. Smith, M.: Primary Tracheal or Bronchial Diphtheria, Brit. M. J. **2**:57 (July 10) 1915.

4. Lowder, Trevor A.: Tracheal Diphtheria, Practitioner **106**:375 (May) 1921.

5. Dupuy, Homer: Tracheobronchial Diphtheria, New Orleans M. & S. J. **76**:113 (Sept.) 1923.

laryngoscopic examination was reported, though there was no aphonia. Boelinger [6] wrote on "ascending diphtheria," emphasizing that diphtheria may begin in either the trachea or the bronchi; he stressed factors in diagnosis and treatment already covered by Lynah. Welford [7] reported twenty-four cases of tracheobronchial diphtheria. In seven of these cases autopsy revealed that the disease was primary in the tracheobronchial tree with no membrane in the nose or throat during life.

Most writers agree as to signs and symptoms: (1) an obstructive type of respiration with the classic signs, such as epigastric "dipping," retraction of the intercostal spaces and tracheal tug; (2) cyanosis; (3) restlessness; (4) absence of aphonia, viz., a clear voice; (5) emphysema and consequent tympany; (6) toxemia with myocardial involvement, and (7) an expiratory type of dyspnea like that of asthma.

With these ideas in mind we present the following case, the diagnosis of which was made even more difficult by a confusing history of foreign body.

REPORT OF A CASE

An infant was admitted to the hospital because of difficult respiration. About forty-eight hours previously the mother found a piece of chalk in the infant's mouth following a coughing spell. That night the respiration became somewhat difficult. Though the family doctor gave antitoxin intramuscularly (10,000 units), the patient became worse and was referred for supposed foreign body.

The previous medical history and family history were irrelevant.

Examination revealed a white female infant, aged 13 months, with a wheezing, asthmatic type of respiration. The temperature was 102 F. (rectal), the respiratory rate 60 and the pulse rate not charted. A roentgenogram was negative for foreign body and pneumonia.

Because of the history an immediate bronchoscopy was performed with a 4 mm. tube. No anesthesia was given. There was no pathologic process in the throat, larynx or trachea. Both main bronchi were filled with a quantity of fatlike substance, which was coughed freely from the tube. Vision was difficult, but the mucous membranes were apparently very edematous. No foreign body was seen. Mustard plasters, inhalations of steam and digitalis were used postoperatively. (Edmunds and Cooper,[8] by animal experimentation demonstrated the rationale of moderate digitalization in diphtheria.)

The patient continued to have a temperature of from 102 to 104 F. (rectal), with a respiratory rate of from 48 to 60 and a very rapid pulse rate. In twelve hours respiration had become increasingly difficult, with cyanosis, a definite expiratory type of dyspnea, emphysema and tympany. To facilitate aeration and repeated aspiration, a low tracheotomy was performed. A culture was taken from the

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6. Boelinger, M. P.: Tracheobronchial Diphtheria, New Orleans M. & S. J. **78**:84 (Aug.) 1925.

7. Welford, N. Turner: Tracheobronchial Diphtheria: Report of Twenty-Four Cases, Am. J. Dis. Child. **37**:944 (May) 1929.

8. Edmunds, C. W., and Cooper, R. G.: Action of Cardiac Stimulants in Circulatory Failure Due to Diphtheria, J. A. M. A. **85**:1798 (Dec. 5) 1925.

trachea, though we did not yet suspect the true diagnosis. Direct laryngoscopy showed a normal larynx except for the reaction from bronchoscopy.

We were surprised when the culture was reported heavily positive for diphtheria bacilli; 4,000 units of antitoxin were given intravenously, but the child died forty-eight hours after admission to the hospital.

Autopsy.—Permission was given for only a limited autopsy. There was no membrane in the trachea. The right main bronchus was completely closed by a hard granular cast about one-half inch (1.2 cm.) in length. No air could possibly have gotten through this obstruction, though the indentures at the ends of the cast indicated that a small airway had existed. (The cast readily dissolved in salt solution.) An incomplete cast was present in the left bronchus. The bronchial tree gave widespread evidence of an acute infection, though evidence of membrane other than the casts was lacking, probably due to the short duration. There was, of course, marked emphysema.

COMMENT

Had we known the true nature of the condition, we probably would have performed a second bronchoscopy in twenty-four hours, as aspiration by suction is the treatment par excellence for bronchial involvement. This might have prevented the formation of casts.

In cases of this kind, Lynah used intubation tubes made longer than the O'Dwyer tubes. He did not favor tracheotomy.

In tracheobronchial diphtheria, either primary or secondary, we believe in low tracheotomy with repeated aspiration by a suction machine with an attached catheter, through the tracheal cannula. The machine is kept in the room and is used by the nurse. Warm liquid petrolatum in the tube is a valuable adjunct. (Bronchoscopy is performed, of course, if necessary.)

Though we have seen in consultation, in the last eighteen months, thirty-four cases of diphtheria of the respiratory tract, the case presented is the only one in which the condition was wholly primary in the trachea or bronchi. Tracheotomy was performed in 26 per cent of the cases, usually for involvement below the larynx, and occasionally because of difficulty in extubation. The mortality for the whole group was 23 per cent; for the tracheotomized group, 44 per cent. Several patients in the latter group were moribund when consultation was sought, which does not make it quite a fair percentage.

In the case cited, attention is especially called to the expiratory type of dyspnea with emphysema and tympany. It is easy to see how such a case might be diagnosed acute asthma or so-called capillary bronchitis. Modern methods of endoscopy and direct culture of bronchial secretions constitute a scientific diagnostic and therapeutic approach, which should be used early to reduce the mortality in this fatal type of diphtheria.

PARALYSIS OF THE ABDUCENS NERVE ACCOMPANYING A CASE OF MASTOIDITIS

AN UNUSUAL FORM OF GRADENIGO'S SYNDROME *

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The triad of symptoms designated as Gradenigo's syndrome is sufficiently classic to be considered a distinct clinical entity. This syndrome was first definitely pointed out by Gradenigo [1] in 1904, its three characteristic features being: (1) paralysis of the external rectus muscle supplied by the abducens nerve, (2) unilateral pains in the temporoparietal region on the same side and (3) the presence of an otitis media on the affected side. He described the usual course as follows:

1. The condition more often occurs in younger patients.

2. The otitis media is usually, though not always, acute and is commonly accompanied by mastoiditis.

3. The tympanum may or may not be perforated.

4. Diplopia sets in suddenly about a month after the onset of symptoms of the middle ear.

5. Optic neuritis is usually absent. However, when present, it indicates a coincidental infection of the optic nerve.

6. About two months after the onset of the otitis media, particularly following surgical intervention, the pain and diplopia tend to disappear.

7. Occasionally, though rarely, diffuse meningitis becomes established, and the case then ends fatally.

When the syndrome occurs in the course of acute otitis media, it appears in the preoperative stage in the vast majority of cases, usually necessitating surgical intervention. However, according to the available literature, there are instances in which this syndrome occurs as a postoperative complication. These instances are not so common and are rather difficult to explain, especially when the operation, either a simple or a radical mastoidectomy, has failed to reveal any abnormalities in the bony cortex, such as dehiscences or breaking down of the bony shell of the tip of the mastoid process. In such instances there may be a history of a latent infection from a recent preexisting inflammation such as influenza, recurrent otitis media, etc.

* Submitted for publication, Nov. 28, 1930.

1. Gradenigo, G.: Bull. d'oto-rhino-laryng. **7**:37, 1904; Gior. d. r. Accad. di med. di Torino **0**:181, 1904.

The case of a patient whom I treated recently, which I shall describe, comes under this postoperative group. It is interesting not only because of this feature, but because it presented an additional complication which to my knowledge has not been recorded previously—a transitory ptosis and edema of the upper eyelid on the opposite side, accompanied by a mild facial neuralgia. Another unusual feature was that the paralysis of the abducens nerve preceded the unilateral facial pains. This case also demonstrated the prompt efficacy of blood transfusion in controlling the toxic factors of the disease.

REPORT OF CASE

R. W., a boy, aged 9 years, was first seen by me on March 29, 1930, at which time he presented typical catarrh of the head, mild bilateral antral sinusitis and congestion of the pharyngeal mucosa. He also complained of some pain in the right ear. The right drum was slightly hyperemic and showed a mild bulging; the landmarks were visible and fairly normal. There was no pain or tenderness in the region of the mastoid. The temperature was 100 F.; the pulse rate, 82. The drum of the left ear was normal; both tonsils showed chronic inflammation, and there was considerable adenoid tissue. Under conservative treatment this condition cleared up in six days, the congestion and bulging of the right drum disappearing in forty-eight hours.

On June 8, nine weeks after the disappearance of all of the signs, the patient awoke at 5:00 a. m. with a severe, lancinating pain in the right ear, radiating to the temporal and occipital regions on that side. When I saw him at 10 a. m., there was a small spontaneous perforation in the upper posterior quadrant of the right drum. There was evident at this time a scanty, thin, serous discharge coming out under pressure pulsations. The pains had practically subsided, with the exception of some tenderness anterior to the tragus. The temperature continued to mount, reaching 104 F. the next day, and fluctuating between 100.4 and 103 F. during the following day. There was not much pain, but the discharge, which had no foul odor, was beginning to diminish. Myringotomy was performed on June 11; a good-sized opening was obtained, and considerable blood and serum were released. The temperature dropped to 100 F., and the patient felt considerably relieved. However, on the next day the temperature rose to 104.5 F.; the patient became drowsy and quite restless and complained of pain in the region of the mastoid on the right side and also over the tragus and tip of the mastoid process. There was no vomiting or vertigo, and the patient (nervous and hypersensitive ordinarily) became fidgety and difficult to control. At this time, the right ear showed a slight drooping of Shrapnell's membrane with a scanty, mucopurulent, nonodorous discharge. Politzerization several times that day aided in increasing the discharge, which brought the temperature down to 100 F. and gave the patient much relief. Cultures from the nose and throat were negative. A pediatrician examined him and found nothing unusual, except the condition of the ear described. Urinalysis also gave negative results, except for a faint trace of albumin. From June 12 to 18 the discharge was copious and always under marked pressure, there being no foul odor. The temperature ranged between 98 and 100 F.; he had few complaints; the opening in the drum was gaping well, and there was no additional sagging or drooping of the posterior superior bony wall. The roentgenologist reported that there was diminished transmission of rays through the mastoid cells on the right side, suggesting granulations or pus. The mastoid

was of the small cell type. There was no definite evidence of destruction of the intercellular septums.

On June 19, the temperature rose to 102.4 F., the pulse rate was 130, and the pain increased over the right mastoid. Shrapnell's membrane showed increased sagging, although the canal was not much narrowed. The discharge was as before. On June 22, fourteen days after the onset, the patient for the first time presented a postauricular edema with the right auricle displaced forward. The next morning the canal was fairly stenosed, and an operation was decided on, in spite of the fact that the temperature was 100.5 F. and the patient was quite comfortable. A white count showed: leukocytes, 15,400; polymorphonuclears, 77; eosinophils, 2; basophils, 1; lymphocytes, 14, and unclassified cells, 6.

A simple mastoidectomy was performed on the right side with the patient under ether anesthesia. Extensive granulations and considerable pus were found in the mastoid cavity. Smears and cultures yielded *Streptococcus hemolyticus.* There was some extension toward the zygoma, where several large cells were found engorged and were exenterated. Considerable bony cortex was removed in the retrosinal region, revealing a number of cells in that locality that contained pus as well as granulation tissue. There was no exposure of the dura or wall of the sinus, as the bony cortex in these regions appeared clean, smooth and glistening. The tip was extensively involved, though not broken through. No dehiscences were revealed in the bony wall. The antrum was located rather deep and high and a good communication obtained therein. The region of the horizontal semicircular canal and the facial nerve showed no involvement. One strip of gauze containing iodochlorhydroxyquinoline was inserted and loosely packed in the mastoid cavity, and the upper two thirds of the wound was closed with catgut sutures.

On June 24, the patient's condition was good; the temperature varied from 99 to 101 F., the pulse rate, from 100 to 110, and there were no pains. Toward noon of this day (the sixteenth day after onset) a convergent strabismus was noted, and he complained of diplopia. The drainage was within normal limits. Ophthalmoscopic examination of the eyes showed both fundi normal; both pupils reacted equally and well to light and in accommodation. A neurologist found no abnormalities except a mild bilateral Kernig's sign. He also found both eyegrounds normal.

A provisional diagnosis of Gradenigo's syndrome was made, with the possibility of a septic sinus thrombosis forming at the jugular bulb. One had to consider also a possible retained secretion as well as meningitis sympathetica, as described by Plaut and Schotmüller, involving the region of the bulb. The neurologist advised against a lumbar puncture at this time because of the danger of disseminating any infection in, or of further irritating, the cerebrospinal system.

There was no change for three days, during which time the gauze was removed and a fresh, smaller strip loosely inserted. On June 28, the temperature rose suddenly to 104 F. at 1 p. m. The patient became somnolent; he complained of severe pains in both eyeballs, more in the right, and also of severe headaches in the right frontal and temporal regions. He became extremely irritable, but showed no opisthotonos. The neurologist examined him again at this time, with the following observations: The eyegrounds were normal; there were no pyramidal signs on either side; the abdominal and plantar reflexes were normal; there was a mild bilateral Kernig's sign.

At this time a definite diagnosis of Gradenigo's syndrome was justifiable, though the route of extension could not be explained. There was no nystagmus, abnormal past-pointing or vertigo, which eliminated the possibility of an infective process by extension through the labyrinth to the meninges. In view of the fact that the

bony cortex in the mastoid cavity appeared sound as far as could be ascertained, one had also to consider the possibility of an extradural or epidural abscess.

On this day, there also developed suddenly a ptosis of the left upper eyelid accompanied by severe pains in the left eyeball. This condition continued for twenty-four hours; then it disappeared and did not recur. A blood culture was reported sterile after four days. A complete blood count was also made and showed: erythrocytes, 3,800,000; hemoglobin, 80 per cent; leukocytes, 15,440; polymorphonuclears, 74; eosinophils, 2; lymphocytes, 22; basophils, 2; the red cells showed some poikilocytosis and achromia; the platelets were normal. Blood was also taken for matching for transfusion.

On July 1, a transfusion of 300 cc. of citrated blood was given by the indirect method. No protein reaction occurred. The next day the temperature dropped to normal, and there was no complaint of pains. The wound was granulating well, drainage was satisfactory, and the packing was removed. All subjective and objective symptoms had cleared up, except the diplopia and paralysis of the right external rectus. On July 7, the patient was up and about, and his condition was satisfactory. The diplopia had disappeared completely. A test with the *2A* audiometer showed a 28 per cent loss of hearing in the right ear as compared with a 6 per cent loss in the left. The patient was discharged to his home on July 9.

Residual palsy of the right external rectus continued for a while, and under mild dosage of homatropine, 0.25 per cent, it gradually diminished, and medication was stopped on August 1. At this time there was complete excursion of the right eyeball to the side of the right temporal region. The patient showed a slight convergent squint, which he was able to correct by voluntary effort. His hearing now showed only a 14 per cent loss in the right ear with the *2A* audiometer. His physical condition was excellent; he had gained 8 pounds (3.6 Kg.), and there was no discharge either from the wound or from the canal of the ear.

COMMENT

The exact cause or reason for the development of Gradenigo's syndrome is still open for discussion. However, the location of the pathologic change is generally accepted. In his original communication in 1904 and in subsequent papers, Gradenigo ascribed the cause of the involvement of the abducens nerve as most likely due to a localized meningitis involving the apex of the petrous portion of the temporal bone in the region of Dorello's canal. This inflammation may proceed through extension of suppuration of the middle ear via pneumatic cells in the region of the eustachian tube, these cells sometimes reaching the tip of the pyramid. Dehiscences or erosion in the tip of the mastoid process can easily involve the abducens nerve on account of its proximity to the tip.

Perkins [2] stated that the route of infection or involvement of the abducens nerve may be one of the following: (1) the sublabyrinthian route, extending from the tympanum below the labyrinth and internal auditory meatus to the petrous tip; (2) by the way of the carotid canal, through erosion of the anterior tympanic wall or through the carotico-

2. Perkins, C. E.: Ann. Otol., Rhin. & Laryng. **19**:692, 1910.

tympanic foramen, which gives passage to the carotid branches of the tympanic plexus; (3) through the petromastoid canal, the infection extending from the mastoid antrum through the subarcuate fossa, passing inward beneath the superior semicircular canal, the infection thus reaching a layer of cells that sometimes lies above the internal auditory meatus and eventually locating at the petrous tip; (4) through a layer of cells extending along the eustachian tube, thus passing from the tympanum to the tip.

Other routes are also possible as the abducens nerve often takes anomalous routes, as Dittman [3] pointed out. The nerve may likewise be secondarily involved with an epidural abscess in that region.

ANATOMY OF THE ABDUCENS NERVE

The anatomy of the abducens nerve and its adjacent structures should be considered in order to make comprehensible the coincidence of the symptoms of the syndrome. The abducens nerve passes from the brain at the inferior border of the pons under the dura on the basilar surface of the sphenoid, then enters the cavernous sinus, passing forward through the entire length of this sinus. It is separated from the dura only by a layer of connective tissue. From here it may take various courses, either lying in contact with the external wall of the inferior petrosal sinus or piercing and entering the lumen of the latter. For practical purposes, however, it should be noted that the nerve lies in actual contact with the apex of the petrous portion of the temporal bone for a distance of several millimeters. There is a distinct groove in the bone at this point, marking the location of the nerve.

The association of facial pain with the paralysis of the right rectus nerve is due to the close proximity of the gasserian ganglion to the abducens nerve in Dorello's canal. This canal is a bony space situated between the apical point of the deepest portion of the temporal bone and the mesial wall of the sphenoid body. It is lined and protected in its uppermost portion by the petrosphenoid ligament, which extends from the posterior clinoid process of the sphenoid bone to the sphenoidal spine of the temporal bone. Any undue pressure or edema in this canal may numb or completely inhibit the function of the nerve contained therein. The structures contained in this canal are the abducens nerve and the inferior and superior petrosal sinuses. The gasserian ganglion and part of the first two branches of the trigeminal nerve are in close proximity to the abducens as that nerve makes its exit from the cranial cavity.

As stated before, the course of this nerve is not constant. At the anterior end it is situated lateral to and above the inferior petrosal

3. Dittman, G. C.: Minnesota Med. **3**:439 (Sept.) 1920.

sinus; then it passes between the two venous sinuses and comes into fairly close contact with the gasserian ganglion which is separated from the abducens nerve only by the superior petrosal sinus. In other words, the proximal portion of the sixth nerve in Dorello's canal is accompanied by the inferior petrosal sinus, whereas on emerging it is found to be in close proximity to the gasserian ganglion and the superior petrosal sinus. It is readily seen that the amount of facial pain in a case of Gradenigo's syndrome depends on the location of the irritation to the nerve, whether it is farther away from or nearer to the ganglion.

From the relationship of the abducens nerve to the venous channels and to the internal carotid artery, it can be readily comprehended that this nerve is particularly sensitive to early involvement and prone to metastatic infection. The inflammation or irritation of the pia-arachnoid in that region may be caused by changes in the adjacent infective focus, this condition having been designated as the meningitis sympathetica of Plaut and Schotmüller.

CLASSIFICATION OF GRADENIGO'S SYNDROME

Various types or classifications of Gradenigo's syndrome should now be considered. In his original paper, Gradenigo reported the results of a study of fifty-eight cases, which he classified as follows:

1. Twenty-five cases showing the typical triad in the course of an involvement of the mastoid without other untoward complications. These cases progressed favorably, ending in complete recovery from the ocular paralysis.

2. Twenty-nine cases presenting the typical syndrome, but in which other complications also developed, including paralysis of the facial nerve, optic neuritis and labyrinthitis. He considered these complications as coincidental or independent. This group presented more severe symptoms, though most cases resulted in recovery. The case that I reported falls under this classification.

3. In the last group consisting of four cases in which septic meningitis developed, all of the cases proved fatal. This type he regarded as the most virulent form.

Gradenigo's syndrome, which develops during the course of an infection of the mastoid, usually manifests itself prior to the operative stage, although there are cases on record that occurred subsequent to mastoidectomy. Perkins, in his excellent analysis of ninety-five cases collected from the literature, reported as follows: Sixty occurred before mastoidectomy, twenty-seven after mastoidectomy, and in eight the time of onset was not stated. In the sixty cases occurring before mastoidectomy, twenty-nine patients were operated on, resulting in twenty-seven

cures and one death; in one case the paralysis was permanent. In the remaining thirty-one cases, twenty-five patients recovered and four died, while two cases resulted in a partial recovery from the paralysis of the abducens nerve.

These analyses and later reports show that many patients recover without undergoing operation on the mastoid, though usually when the diagnosis is definitely established mastoidectomy is indicated for the relief from pressure and drainage of any infective material. Thus paralysis of the abducens nerve per se is not an indication for operation, but the degree and intensity of the pain, together with evidence of insufficient drainage, would point to operative intervention.

While Gradenigo's syndrome is essentially an otitic complication, it has at times first come to the attention of the ophthalmologist. Wheeler [4] reported several cases in 1918.

The thought has often occurred to me, as it no doubt has to others, that the trauma caused by the malleting and chiseling attending a mastoidectomy might cause a congestion or even a concussion in the middle fossa, or a hyperemia of the meninges around the petrous portion of the temporal bone. Thus a transitory diplopia or mild palsy of the abducens nerve might occur and simulate a Gradenigo syndrome. Further inquiry along this line may reveal some interesting facts.

PROGNOSIS AND TREATMENT

When the syndrome occurs, it causes the otologist considerable anxiety, because it may be the forerunner of a general leptomeningitis. The mortality is variously reported to be as low as 2 per cent and as high as 20 per cent, depending on the presence of other complications. Each case, however, presents an immediate potential grave prognosis, the danger lasting from a few days to a week.

A study of many of the cases recorded indicates that the majority of patients eventually recover completely, although the duration may be from several days to a few months. However, as Gradenigo pointed out, when diffuse meningitis sets in, which is usually streptococcus meningitis, the case terminates fatally, especially if treatment is not given. Some patients recover without undergoing operation, while others who have been operated on show little or no pathologic change in the mastoid cells. In some of the cases in which a mastoidectomy had been done, although it seemed questionable that drainage at the apex of the petrous portion had been enhanced, a strikingly speedy recovery immediately took place. Wheeler and Perkins are among others who have recorded such instances.

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4. Wheeler, J. M.: Cranial Nerve Paralysis, J. A. M. A. **71**:1718 (Nov. 23) 1918.

It may be noted here that there is not a case on record in which the signs have persisted or have remained unimproved for more than a week after the operation. The pain, particularly in these cases, is nearly always immediately relieved following mastoidectomy. On the other hand, the pains are often unaffected by large doses of morphine or codeine. In view of these facts it is a wise procedure to treat the patient conservatively with palliative measures for the first week, unless active signs of disease of the mastoid are present. Repeated myringotomies may be necessary during this period. If, however, after this interval no relief is manifest, it is unwise to delay the operative procedure further. Usually, a Schwartze operation, during which a careful search for infected cells is made, suffices. If the involvement is extensive, a radical or a modified radical operation is indicated. Neumann suggested that when a Gradenigo syndrome supervenes after mastoidectomy, a conservative radical operation should be performed, with the removal of the incus and the head of the malleus.

The attempt should also be made to increase the patient's resistance by means of transfusions of blood. This measure is strongly urged, as it accomplishes two main purposes: (1) It tends to overcome the bacterial infection, and (2) it will often abort a developing septic sinus thrombosis. I am convinced that in my case the transfusion was a decisive factor in the prompt amelioration of the symptoms and the rapid recovery.

Potassium iodide may be given early. Absorption may be aided by the use of pilocarpine or jaborandi. Tonics containing strychnine are of value after the acute stage has subsided. It is important to keep the affected eye covered with a dark patch or with a piece of gauze. This is not only restful for the eye, but it seems to lessen the pain somewhat. Later, massage and faradism may be of benefit, particularly if the palsy of the abducens nerve has persisted for more than four or five months. In the early stages homatropine, 0.25 per cent, or atropine, 1 per cent, may be used for a short time.

Lumbar puncture as a diagnostic aid is advocated by a number of physicians, but it should be approached with a conservative attitude. Recent opinion reveals a tendency not to tamper with the spinal canal unless there is grave doubt as to the diagnosis, or if the condition shows a tendency to become worse.

In the main, then, the treatment usually resorted to is surgical intervention. There are cases on record in which the diplopia and the paralysis of the abducens nerve have cleared up after numerous myringotomies which were sufficient to eliminate the infection. However, inspection and evacuation of the mastoid contents usually bring about prompt relief from all symptoms. This procedure also permits an examination of the dura, the lateral sinus or other deeper structures which may be suspected of being involved.

SUMMARY

In summing up, I desire to stress the following points:

1. Gradenigo's syndrome seems to occur in children more often than in adults.

2. The sequence of symptoms of this triad is not always the same.

3. This condition is potentially serious in each instance, and the prognosis should be guarded.

4. The syndrome is usually ushered in from three to four weeks after the onset of acute otitis media.

5. At times an unexplained complication will occur. In this case the transitory ptosis of the upper eyelid on the opposite side has not been accounted for.

6. This otitic complication may occur after mastoidectomy, although it usually precedes the latter.

7. In the differential diagnosis, among the conditions to be considered, are: septic sinus thrombosis, thrombosis of the jugular bulb, epidural abscess, syphilitic (latent) meningitis and diffuse purulent or serous labyrinthitis.

8. The treatment is essentially surgical, a Schwartze operation usually sufficing.

9. Lumbar puncture, unless definitely indicated, should be delayed for fear of disseminating an infection or of irritating the meninges.

10. Transfusion of blood should be employed early in septic cases rather than as a later emergency measure.

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IMPLANTATION OF IVORY IN OZENA

APPROVED TECHNIC; FURTHER OBSERVATIONS *

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Since the appearance of my article [1] on ozena over a year ago, so many inquiries about the operation have been made that I decided to write this paper elucidating the operation and adding my further observations on the implantation of ivory.

TECHNIC

I obtain my ivory from V. Mueller and Company, Chicago, in blocks of four sizes (1 by ⅜ by ⅜ inch), (1¼ by ⅜ by ⅜ inches), (1⅜ by ⅜ by ⅜ inches), (1 by ¼ by ¼ inch). The first two sizes are used most frequently; occasionally the last one is more appropriate. These blocks are taken to a dentist, who rounds off all corners and flattens out all edges with his carborundum driven by an electric motor.

The patient's nose is douched thoroughly with physiologic solution of sodium chloride to which a little sodium bicarbonate is added, until all crusts have been removed. He is then put on the operating table in a semireclining position, and the face is cleansed with soap and water, alcohol and ether and draped with sterile towels, exposing the nose and mouth. The mucous membrane of the floor of the nose on the side chosen for operation and of adjacent parts of the septum and of the lateral wall is well cocainized by gentle application of an applicator wound in cotton and soaked in a mixture of 5 drops of 20 per cent cocaine and 5 drops of epinephrine 1:1,000. The alveolar process, including the upper lip, is then swabbed twice with a 2 per cent solution of mercurochrome-220 soluble. The area is exposed by retraction of the upper lip upward and the angle of mouth outward. The anterior surface is infiltrated either with 0.5 per cent procaine hydrochloride to which a little epinephrine is added or with a 1 ounce physiologic solution of sodium chloride to which are added 5 drops of 20 per cent cocaine and 6 drops of epinephrine. One or 2 cc. of this solution is ample for the operation. The infiltration should extend from the frenum to the first bicuspid. An incision is made throughout this length through mucous membrane and periosteum at the junction of the lower and middle third of the alveolar process. The periosteum is elevated to the sharp ridge of the apertura pyriformis. A narrow retractor is then placed inside the periosteum, and with a Knapp's metal lens scoop as an elevator, the ridge is exposed; then the floor of the nose is elevated slowly, and with utmost care, until a deep and wide pocket is formed. The elevation should extend on to the septum as well as to the lateral wall under the inferior turbinate. The slightest tear in the mucosa at this stage will defeat the purpose of the operation. The greatest difficulty is encountered at the ridge, which is considerably

* Submitted for publication, Nov. 21, 1930.

1. Kemler, Joseph I.: Ozena: Report of Cases, Arch. Otolaryng. **10**:61 (July) 1929.

higher than the floor, and hence the elevator should be markedly depressed when the floor of the nose is approached, constantly hugging the bone. The rest separates rather easily. The largest suitable piece of ivory, which has been boiled for ten minutes, is introduced into the cavity (fig. 1). The ivory should fit rather loosely in place, or else the patient will have too much of a reaction. Two or three black silk sutures close the wound. The nasal cavity should be inspected with the elevator in the newly formed cavity before the ivory is introduced, to ascertain the extent of the elevation. After the operation is completed, a piece of dry gauze is introduced into the nose to stimulate the mucosa further. A piece of gauze folded several times is placed over the lip and tightly secured with adhesive strips. Both pieces can be removed in from twenty-four to forty-eight hours.

The patient is either sent home or remains in the hospital for the next two or three days. During this time an ice bag is applied to the side of the face, and the patient is kept in bed. There is usually some swelling over the cheek

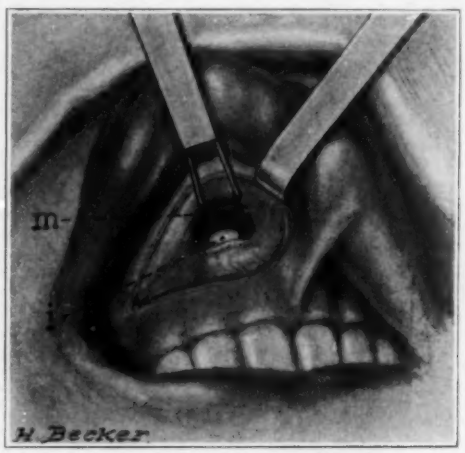

Fig. 1.—Floor of the nose dissected up and the ivory in place.

and under the eye, with or without discoloration. There is some discomfort but not much pain. The temperature may rise to 100 F. or higher if the ivory fits too tightly. After the reaction has subsided, no further treatment is necessary. The beneficial effects can be seen immediately, owing to the reaction of the operation, and when this subsides the implant acts as a constant irritant, besides narrowing the nasal chamber. The elevation of the floor of the nose becomes greater soon after the operation, owing to the formation of a capsule around the foreign body.

COMMENT

Since the definite etiologic factor is still unknown, a rational therapeutic method of treatment of ozena cannot be hoped for. Yet within the last few decades experiences have taught that narrowing the nasal chamber with the concomitant stimulation to the mucous membrane relieves the patient, if not of all symptoms, at least of the most distressing ones, namely, fetor, headaches and the formation of large

crusts. Occasionally patients have to douche their noses or spray a little petrolatum to keep the mucous membrane moist to make up for the lack of natural secretion. The operation of Lautenschlager,[2] wherein he cleans out the sinuses, transplants Stenson's duct into the antrum and narrows the nasal chamber both by moving the lateral wall of the nose toward the septum and implanting bone into the floor, should be ideal in eradicating this disease. But this operation is formidable, requiring hospitalization for several days and after-treatment for a long period. In only one case did I find it necessary to clean out the sinuses by a simple intranasal operation before narrowing the nasal chambers, and the patient has remained well for fifteen years. All the rest of my patients have done well without attention being paid to the sinuses. Even if one accepts the theory of Gottstein,[3] that ozena is a result of some inflammatory process, the reaction obtained by the implantation of the foreign body may have a curative effect on the subacute or the mild inflammation. Lautenschlager,[4] who holds Gottstein's theory to be true, also states that the operation should be undertaken early while the process is still going on in order to get the benefit from the reaction.

The discomfort caused by the new position of the parotid duct may offset the favorable results obtained from letting saliva constantly flow into the nose.

The most important part of any operative procedure is narrowing the nasal chambers, which can best be accomplished by submucous implants without disturbing the original anatomy of the nose and accessory sinuses (figs. 2 and 3).

Bernheimer,[5] Pollock,[6] Denker,[7] and others grant the beneficial results from implantation of foreign substance, but claim that it is only palliative, because implants are extruded; yet in my experience of about twenty years, I have often seen patients with perfectly good nares who have told me that they were operated on by me many years ago, and on reading their case records, I find that they had typical ozena.

I have obtained the best results from the implantation of paraffin, as described in my previous paper, and I have never seen any migration or loss of the implant. Since I have discontinued the use of paraffin

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2. Lautenschlager, A.: Arch. f. Laryng. u. Rhin. **31**:103, 1918.
3. Gottstein, cited by Lautenschlager (footnote 4).
4. Lautenschlager, A.: Arch. f. Ohren-, Nasen- u. Kehlkopfh. **120**:7 (Jan.) 1929.
5. Bernheimer, L. B.: Illinois M. J. **55**:420 (June) 1929.
6. Pollock, H., in discussion on Bernheimer (footnote 5).
7. Denker: Deutsche med. Wchnschr. **56**:379 (March 7) 1930.

I have found that autogenous bone grafts taken from the rib, implanted in the septum, serve the purpose admirably, and patients so operated on over seven years ago still have the grafts in place. However, ivory implanted into the floor, as described, has proved very efficient, with practically no trouble in its introduction. It is now five years since I began using this operation. A fairly large number of patients have been so treated by me and my assistants. Only one piece of ivory was extruded, and this occurred in one of the earliest cases because the ivory had quite a sharp edge. No loss of ivory has been noted by any of us since we have rounded off all corners and smoothed all edges. All the ivory introduced into the septum was extruded after

Fig. 2.—Roentgenogram of the lateral view of the head showing the ivory on the floor of the nose.

a shorter or a longer period, and hence I gave up this method of operation. Successive introductions, as suggested by Bernheimer,[5] are valueless when a permanent implant is possible. This operation is best adapted in typical cases of ozena when the septums are straight and the floors are wide. In cases with markedly deflected septums in which the opposite side is practically occluded, I break the septum over to the midline and then implant the ivory in the floor of one or both sides. If, however, I find one good side quite narrowed by a convexity of the septum, with a very wide opposite side with a markedly atrophic or absent middle turbinate, I should be tempted to introduce the ivory as usual in the wider side, and at a later date, if the condition demands

it, implant an autogenous rib graft or crest of ilium into the septum, as suggested by Unterberger.[8]

The superiority of ivory over all other foreign substances has been well illustrated by many authors, as I mentioned in my last paper. The objection raised by Charschatz,[9] that bone is absorbed eventually, is well sustained. But in absorption new bone is formed, and the process of regeneration acts as a stimulus to the nasal mucosa with further improvement. This view is also held by Lautenschlager [4] and others.

Fig. 3.—Roentgenogram of the anteroposterior view showing the ivory on both sides in the floor of the nose.

The conservative measures spoken of in my last paper as well as the lately suggested methods, such as massage by Rizzuto,[10] the use of the x-rays and radium by Hubert and Robinson,[11] autochemotherapy

8. Unterberger, S.: Ztschr. f. Hals-, Nasen- u. Ohrenh. **23**:346 (Sept.) 1929.
9. Charschatz, M. J.: Monatschr. f. Ohrenh. **63**:318 (March) 1929.
10. Rizzuto, G. Amorelli: Riv. med. **36**:148 (Oct.) 1928.
11. Hubert, L., and Robinson, G. A.: Radium Therapy in Atrophic Rhinitis with Offensive Odor (Ozena), Arch. Otolaryng. **10**:166 (Aug.) 1929.

by Aleshkoff [12] and vitamin therapy by Glasscheib,[13] are temporary at best. The lasting effect can be obtained only by narrowing the nasal chambers, as demonstrated in this paper; this is best and most easily accomplished by implantation of ivory in a place where it is most needed and least likely to be extruded, namely, the floor of the nose.

1908 Eutaw Place.

12. Aleshkoff, A. A.: Vrach. gaz. **33**:2203 (Aug.) 1929.
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Clinical Notes

A METHOD OF NASAL PACKING FOLLOWING SUBMUCOUS RESECTION OF THE SEPTUM WHICH ALLOWS FREE NASAL RESPIRATION*

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The uncomfortableness and annoyance to the patient of having his nasal respiration completely obstructed by packing the nasal fossae, together with the dangers of secondary otitis media and sinusitis because of the nasal obstruction, are so well known to rhinologists that I need not elaborate on them.

There are two methods in use for the after-treatment of the nasal septum following submucous resections, namely, one that provides for the packing of the nasal fossae with petrolatum gauze strip and another that omits the packing. The rhinologists who omit the packing do so because of the annoyance to the patient which the blocking of the nasal respiration causes, such as parched mouth from enforced oral respiration, pain in the ears on deglutition and difficulty in swallowing, and also because of the dangers of setting up an infection of the middle ear or of the sinus. On the other hand, others employ packing of the nasal fossae in spite of the foregoing disadvantages, because when the packing is omitted, other disadvantages are incurred, namely, secondary hemorrhage, hematoma and, perhaps, the formation of an abscess.

I have observed the results on the septums in which nasal packing was omitted as compared with those in which packing was used, and can say from these observations that a hematoma, even though small, occurred more frequently in the former, which in some cases resulted in local thickening on the septum from some of these small hematomas. Secondary bleeding was disquieting in all of the cases, even though the bleeding arrests itself when left alone.

Therefore, it seems that the ideal method would be to pack the nasal fossae and yet allow free nasal respiration. To accomplish this end, I tried overlaying the nasal septum with a plaque of gauze smeared with petrolatum, one in each nasal fossa, that is, pasting, so to speak, a strip of the gauze, about 1 by 2 inches (2.5 by 5 cm.), against the nasal septum, expecting this to hold the two flaps of the septums of mucous membrane in firm contact. This method failed.

Now I take two pieces of smooth rubber tubing, cut from a size 22 French rectal catheter, and insert one into each nasal fossa for about 2 inches from the nostril. The rubber tubing rests on the floor of the nose. After the tubing is in place, the nasal fossae are packed in the usual way with the petrolatum gauze strip. The patient can always breath comfortably through the rubber tubing.

Occasionally, but seldom, one or both tubes become obstructed with mucus. The lumen is then readily cleared by the injection of a few cubic centimeters of sterile salt solution into the tube and the expulsion of this fluid by the injection of air.

* Submitted for publication, Sept. 12, 1930.

COMBINED TONGUE DEPRESSOR AND PILLAR RETRACTORS*

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The object of the new instruments was to combine in one instrument what ordinarily is carried out by two. There are two models. One combines in the same tongue depressor a flange on each side for retracting the pillar. The other

Combined tongue depressor and pillar retractor.

is a combination of two tongue depressors, one serving as a handle while the other is used as a depressor. This is arranged with a flange on one side and can be used for the right or the left tonsil.

* Submitted for publication, Dec. 10, 1930.

CAVERNOUS SINUS THROMBOSIS IN A CHILD FOLLOWING TONSILLECTOMY*

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Cavernous sinus thrombosis is thought to be the result of infection of either the paranasal sinuses or the upper lip and nasal vestibule. It is rarely seen in primary acute disease of the sinuses but more often in secondary acute diseases.

Cavernous sinus thrombosis is common in cases of ill treated furuncles on the upper lip and nasal vestibule, and the cause is well understood. To date I have not found in the literature any instance of thrombosis of the cavernous sinus following infection in the fauces or throat. Therefore, I am reporting the following case so that it may be made a matter of record.

* Submitted for publication, Dec. 11, 1930.

REPORT OF CASE

On April 20, 1928, I operated on four children of a Mexican family. One boy, aged 10 years, well nourished and apparently healthy, I had not seen prior to the time of the operation, his family physician reporting him in good condition. He was anesthetized with ether, and on inspection of the throat I noted a subacute inflammation of the right tonsil, sufficient to cause me to pause and debate the advisability of disturbing the throat by operation. However, as the patient was already under the anesthesia, I decided to take a chance.

After removal of the tonsil with the Sluder tonsillectome, there was no unusual bleeding, and the patient behaved as usual until about the third day, when a swelling was noted under and about the angle of the jaw. The cellulitis continued to spread into the neck and up over the face. By the fifth day the right eye was proptosed, the ocular muscles were limited in motion, and the lids were greatly edematous (chemosis). He complained of great pain in the neck and head; he had severe chills and a temperature of from 104 to 105 F. The patient was lethargic, but could be aroused and would answer questions intelligently.

There was no stiffness of the neck. The Kernig sign was absent. Ophthalmoscopic examination of the eyes was impossible. A blood culture was not made. Examination of the throat revealed hard induration of the pillars of the right tonsillar fossa and the palate. No fluctuation was ever found.

On the sixth day the swelling had extended to the other eye, and the patient died before the next dawn.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology for 1930

TUMORS OF THE NOSE AND THROAT*

GORDON B. NEW, M.D.
AND
WALTER KIRCH, M.D.
ROCHESTER, MINN.

GENERAL CONSIDERATIONS

Hajek [1] advocated the use of a combination of surgical intervention and irradiation in tumors of the head and neck. He gave statistics concerning 46 malignant tumors of the nose, sinuses and upper jaw seen during the last ten years, 4 of which were sarcomas and 42 of which were carcinomas. Only 10 of these patients experienced good results and were well for from one and a half to twelve years. Hajek expressed the belief that treatment with radium gives better results than surgical intervention. He advocated intensive irradiation, disregarding necrosis of the bone. The good results were not lasting in the nasopharynx. He treated 4 patients with sarcomas who lived from one to two years. The results were even more unsatisfactory in cases of carcinoma. In the case of fibroma of the nasopharynx, he advocated radical surgical exposure, then implantation of radium. He reported 13 tumors of the tonsils and the hard and soft palate; they included sarcomas, lymphosarcomas and basal cell sarcomas. One patient with sarcoma was well after three years. The other patients were well for too short a time to allow conclusions to be drawn. In the cases of carcinoma, the tumor disappeared early and was soon followed by recurrence. Hajek does not see many patients with malignant tumors of the tongue; they are taken care of by the general surgeons. In 1 case he applied a strong dose of radium, which caused necrosis. The patient was well for seven years. He believed that surgical intervention is preferable to irradiation in the larynx and trachea. Radium and the roentgen rays, although used in inoperable cases, have not given good results. In malignant lesions of the esophagus and hypopharynx, surgical intervention and radium, alone or combined, are alike useless.

* From the Section on Laryngology, Oral and Plastic Surgery, the Mayo Clinic.

1. Hajek, M.: Die Erfolge der kombinierten operativen Behandlung und Strahlentherapie mittels Radium an der laryngo-rhino-otologischen Klinik während der lezten 10 Jahre, Wien. klin. Wchnschr. **42**:1653 (Dec. 26) 1929.

Milligan [2] described the use of radium in malignant diseases of the upper part of the respiratory tract and the esophagus. He stated that destruction of the tumor by the insertion of radium at the periphery has taken the place of the insertion of radium into the center of tumors. It is his belief that great progress has been made in the use of radium in intrinsic growths of the larynx. He cited Harmer's (window) method and Clemenson's complete removal of the alar cartilage. The cases are as yet too recent to afford conclusions as to the permanence of the results, but in a few cases the patients are known to have experienced long periods of well-being. The danger of necrosis of the cartilage has diminished with improvement of technic. Milligan does not agree with Clemenson that complete removal of the alar cartilage is the only way to avoid necrosis. If the radium is well screened, there is no danger. The functional results are excellent. If the carcinoma is extrinsic, the treatment is more difficult. In cases of buccal and pharyngeal carcinoma, he believes that all danger of sepsis should first be eliminated. In order to do this, he inserts the radium through the cheek whenever possible, even performing resection of the mandible in the case of tumors of the tonsil to obtain better exposure. He stated that metastasis occurs unusually early in oral cases. If surgical procedures are to be used, preoperative irradiation will devitalize the malignant lesion and prevent dissemination. He advocates more screening. In nasopharyngeal lesions, he believes it advisable to remove the growth surgically, and then to use irradiation. For the nasopharynx he uses a stent mold, which receives the impression of the tumor and into which the needles are fitted. In carcinoma of the esophagus, the mortality is still about 100 per cent with any form of treatment. Milligan believes that eventually thoracotomy will be the method of choice for approaching the esophagus. The treatment for postcricoid carcinoma is almost as unsatisfactory. The growth is difficult to approach and usually is in an advanced condition when first seen by a physician. Lateral pharyngotomy or thyrotomy with removal of the posterior part of the cricoid cartilage as an exposure for postcricoid growths may be the future method of choice. For metastatic nodes he advocates surgical removal followed by irradiation.

Figi [3] described the treatment used at the Mayo Clinic for malignant lesions of the mouth and throat. This treatment varies according to the site and extent of the growth, the previous treatment and the general condition of the patient. If access is difficult, as in the nasopharynx and hypopharynx, diathermy or irradiation is used. Low grade lesions are excised or destroyed with diathermy, and the lymph

2. Milligan, William: Radium in the Treatment of Malignant Disease of the Upper Air and Food Passages, Practitioner **124**:4 (Jan.) 1930.

3. Figi, F. A.: The Treatment of Malignant Tumors of the Mouth and Throat, Am. J. Roentgenol. **23**:648 (June) 1930.

nodes are removed later. Irradiation is used for high grade lesions. The combination of surgical procedures or diathermy and irradiation often gives excellent results. Biopsy is considered necessary. Epitheliomas are graded according to Broders' method, which has been found of great value. Figi described the various surgical methods used in different areas and mentioned epitheliomas of the lip, nasopharynx, pharynx and tongue, adamantnomas, fibrosarcomas, mixed tumors and fibromas. He advocated radium supplemented by diathermy in the treatment for fibromas of the nasopharynx. Tumors on the base of the tongue are usually active epitheliomas, sometimes lymphosarcomas and adenocarcinomas, and radium is the treatment of choice. Occasionally, in lesions treated early, diathermy gives very good results. Treatment for lesions of the pyriform fossa and postcricoid region gives unsatisfactory results. Such lesions are active and inaccesible. Carcinomas of the larynx should be treated by surgical intervention, as radium is ineffective.

Kahlstorf and Zuppinger [4] reviewed the development of the use of prolonged and filtered irradiation and referred to Regaud, Ferroux, Coutard and Hautant. Kahlstorf and Zuppinger follow Coutard's method of protracted, fractioned roentgen therapy. The main purpose of this method is elimination of caustic rays and the use of the different radiosensitivity of malignant tumors and normal tissue. This difference is much greater with small, filtered doses than with the high doses used formerly. Extensive particulars as to technic were given. The treatment is continued for three weeks. Most of the patients treated are suffering from an advanced stage of the disease. As Kahlstorf and Zuppinger only started using the method in 1929, definite results cannot be given, but they believe them to be favorable. Their 52 cases include tumors of the mucosa of the mouth, tongue, pharynx, base of the tongue and hypopharynx. These investigators also used the method in 4 cases of laryngeal carcinoma, in 1 case of carcinoma of the ethmoid and in 1 case of carcinoma of the upper jaw. Although in most of the cases the condition was hopeless from the beginning, the palliative effects obtained justified treatment.

THE NOSE AND SINUSES

Asherson [5] reported 40 cases of malignant disease of the nose and upper jaw. He concluded that a strong dose of radium can be used without injury to the external skin, eye, brain or optic nerve. Necrosis

4. Kahlstorf, A., and Zuppinger, A.: Unsere Erfahrungen mit der protrahiertfraktionierten Röntgenbestrahlung nach Coutard, Strahlentherapie **38**:199 (Oct. 18) 1930.

5. Asherson, N.: Some Experiences with Radium in the Treatment of Malignant Disease of the Nose and Upper Jaw, J. Laryng. & Otol. **44**:739 (Nov.) 1929.

of the bone occurs only if the bone is in contact with the radium. The primary dose should be adequate, as successive doses have no effect on the growth of the tumor. Asherson gave the dosage used, but did not report the end-results.

Clevenger and Norris [6] reported a case of melano-epithelioma originating in the mucous membrane of the lower turbinate. They did not find a similar case reported in the literature.

Rosenwasser [7] presented a short history of plasmocytoma of the nasal cavity, together with a case, and an extensive bibliography.

Quick [8] described the treatment for malignant growths of the nasal sinuses and nasopharynx. The difficulty of access to these growths and the inflammatory changes complicate the picture and treatment. He found that infection is more often the cause of death than the actual tumor. Adenocarcinoma is the most common type of malignant lesion. In 83 per cent of 136 cases in which treatment was given between 1917 and 1929, the lesion was inoperable. Thirty-nine per cent of these lesions were squamous cell epithelioma, 7.4 per cent adenocystic basal cell epithelioma and 7.4 per cent transitional cell carcinoma. Quick believed that carcinoma is frequently mistaken for sarcoma. Only 10 per cent of the lesions were true sarcomas. Angiosarcoma, myxosarcoma, fibrosarcoma and chondrosarcoma were seen. When present, lymphosarcoma is usually part of a general condition. It appears to originate in the lymphoid tissue of the vault of the nasopharynx and comes next in frequency to transitional cell carcinoma, which originates near Rosenmüller's fossa. The diagnosis is usually made late, owing to the late appearance of the symptoms. Two of the chief symptoms are obstruction and bleeding. Cervical metastasis is frequently the first evidence of the disease, and is present in 73 per cent of cases. In 59 per cent of the cases of malignancy of the antrum, prolonged treatment had been given for supposed inflammatory conditions, and in 45 per cent operations had been repeated. Surgical intervention is unsatisfactory in these cases, except in intrinsic carcinoma of the antrum. Quick expressed the belief that surgical intervention should be combined with irradiation; surgical intervention will give better access to the tumor and at the same time will afford drainage. The surgical approach should be followed by extensive irradiation, which varies according to the type of growth. The treatment, limited to four weeks if possible, consists of both external irradiation and implantation of

6. Clevenger, W. F., and Norris, H. L.: Melanosarcoma Originating in the Mucous Membrane of the Lower Turbinate, Arch. Otolaryng. **12**:81 (July) 1930.

7. Rosenwasser, H.: Plasmocytoma of the Nasal Cavity, Laryngoscope **40**: 576 (Aug.) 1930.

8. Quick, D.: Treatment of Malignant Growths of the Nasal Accessory Sinuses and Nasopharynx, Radiology **14**:191 (March) 1930.

radon seeds. If the tumor is not completely accessible, radon is implanted in the accessible part of the tumor, and further implantation is done as the tumor shrinks and is removed. Quick gave a description of his technic. For metastasis he used a combination of roentgen rays, radium and surgical intervention. Short wave roentgen rays were used if the palpable lymph nodes appeared to be contained in an intact capsule; radium packs were applied, following which dissection and implantation of radon took place. If the capsule was perforated and there was fixation, radium and roentgen rays were used. Transitional cell carcinoma is radiosensitive, and surgical intervention is not indicated. It is Quick's belief that surgical intervention at these sites was only an adjunct to irradiation.

THE NASOPHARYNX

Dalla Palma [9] stressed the significance of nasopharyngeal examination in all doubtful cases in which there was involvement of the cranial nerves. He presented a case in which the third, fifth, ninth, tenth and twelfth nerves were involved. It is his belief that there may be temporary regression of the symptoms of involvement of the nerves due to necrosis of the tumor and lessened pressure on the nerves.

Worms and Carillon [10] reported 8 cases of nasopharyngeal tumors. Lymphosarcoma and epithelioma are the tumors that occur most commonly in this region. The first symptom is usually pain in the ear or paralysis of the fifth nerve. The tumor early infiltrates the floor of the cranium and involves other cranial nerves.

Shaheen [11] reported 58 cases of fibroma of the nasopharynx. The greater number of these arise from the basioccipital or basisphenoid. Changes in development during puberty have been suggested as a factor, but in 3 of his cases the patients were young children and 3 were men aged 48 years or more. The tumors may become malignant. Shaheen has never seen spontaneous involution as described by various authors. The tumor, although histologically not malignant, is clinically malignant. He advocated surgical intervention for this condition. He approached the tumor through an opening in the soft palate in his early cases, but now prefers Moure's lateral rhinotomy. If operation is inadvisable on account of the general condition of the patient, diathermy, roentgen rays or radium can be used. Four deaths occurred following operation.

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9. dalla Palma, Modesto: Contributo alla conoscenza dei tumori craniofaringei, Riforma med. **45**:1339 (Oct. 5) 1929.

10. Worms, G., and Carillon, R.: Tumerus du rhinopharynx à propagation cranienne de leur diagnostic précoce; importance de l'examen radiologique, Rev. d'oto-neuro-opht. **8**:161 (March) 1930.

11. Shaheen, H. B.: Nasopharyngeal Fibroma, J. Laryng. & Otol. **45**:259 (April) 1930.

THE PHARYNX

Canuyt and Micaesco [12] reviewed from the literature 145 cases of carcinoma of the tonsil to which they added 12 of their own. They found that the tonsil is more frequently attacked by carcinoma than the other portions of the oropharynx. They expressed the belief that biopsy is essential and that combined treatment by radical operation, block excision of the lymphatic nodes and irradiation following operation gives the patient a better chance of recovery.

Robinson [13] presented 33 cases of tumors of the tonsil; 27 of the patients were males and 6 were females. There were six sarcomas of various types and twenty-seven epidermoid carcinomas, which were treated with either radon seeds or radium needles, preferably the former. One of his patients remained well for seven years, 1 was well for two and a half years and 1 for two years. Palliation was obtained in all of the cases. The growth was graded 1 in 2 cases, 2 in 4 cases, 3 in 3 cases and 4 in 7 cases.

D'Aunoy [14] found only a few more than 100 mixed tumors of the palate reviewed in the literature. He presented 2 cases of his own; both patients were women. He stated that it is now generally agreed that mixed tumors are due to embryonal displacement of tissues. They are now generally conceded to be epithelial, and their histology is due either to metaplasia or to the inclusion of embryonal tissues. Although on microscopic examination they appear to be malignant, clinically they are benign and recurrences are caused by incomplete removal.

Sonnenschein [15] gave an extensive review of the literature on mixed tumors of the salivary gland, and reported 2 cases in which they were found in the soft palate. He considered their origin, pathologic changes and histology. His conclusions were that the origin has not been determined, that they are individual entities and have no connection to the structures in which they are found and that histologically they are often malignant, although usually clinically benign.

Orton [16] described 9 cases in which he performed lateral transthyroid pharyngotomy for epithelioma of the epilarynx. He had an operative mortality of 22.3 per cent due to pneumonia. The condition recurred in 3 cases after six months, in 1 case after nine months and

12. Canuyt, G., and Micaesco: Le cancer de l'amygdale, Strasbourg méd. **89**:441 (Sept. 5) 1929.

13. Robinson, G. A.: Radium in the Treatment of Tumors of the Tonsils, Am. J. Roentgenol. **23**:643 (June) 1930.

14. D'Aunoy, Rigney: Mixed Tumors of the Palate, Am. J. Path. **6**:137 (March) 1930.

15. Sonnenschein, Robert: Mixed Tumors in the Soft Palate, Arch. Otolaryng. **11**:137 (Feb.) 1930.

16. Orton, H. B.: Lateral Transthyroid Pharyngotomy: Trotter's Operation for Malignant Conditions of the Laryngopharynx, Arch. Otol. **12**:320 (Sept.) 1930.

in 1 case after eighteen months; 2 patients are alive eight months and one year, respectively, after the operation. Squamous cell epithelioma was noted in all cases. In almost all of the cases in women the lesion occurred in the laryngopharynx. Three lesions were postcricoid or of the posterior pharyngeal wall. The lesions in the men were in the arytenoids, aryepiglottic folds, epiglottis, pyriform sinuses and at the base of the tongue. In spite of the poor prognosis, it is Orton's belief that the operation is worth attempting. Tracheotomy was performed as a preliminary operation, and Trotter's technic, which he described, was followed. He operates even if palpable lymph nodes are present, changing the incision in the skin to meet the requirements of the case. He grades the tumors according to the classification of Broders. He gave detailed case reports.

One of us (G. B. N.[17]) reported a fibrosarcoma of the hypopharynx. The lesion was similar to an ordinary fibrosarcoma of the nasopharynx. The best treatment is radium or surgical diathermy. In this case radium was used, and roentgen rays were applied externally. The patient has been well for two years. Tracheotomy was done as a preliminary measure; the opening has since been closed.

Babès[18] commented on the articles of Schmincke, Jouvin, Reverchon, Coutard and Derigs on lympho-epithelioma. He concluded that the so-called lympho-epitheliomas of the pharynx and nasopharynx are really highly malignant carcinomas. This agrees with the stand that Broders has taken as to the nature of these tumors. The invasion by lymphocytes is due to a defense mechanism and to their presence in lymphatic organs. Babès did not find special syncytial disposition of the epithelium or special radiosensitivity. A lympho-epithelioma of thymic origin does exist which repeats the structure of the thymus and which he considered as belonging to the mixed tumors. This is found either in the thymus or in the organs connected with it during development, such as the thyroid or parotid gland. He prefers to call this type of tumor lymphoido-epithelial tumor, as it is not a true epithelioma.

THE LARYNX

Thomson[19] described the treatment for carcinoma of the larynx. If carcinoma is extrinsic, it is beyond aid by surgical intervention. Intrinsic carcinoma, if diagnosed early, can be treated conservatively

17. New, G. B.: Fibrosarcoma of the Hypopharynx, S. Clin. North America **10**:98 (Feb.) 1930.

18. Babès, A.: Les tumeurs lympho-épithéliales, Ann. d'anat. path. **6**:1105 (Nov.) 1929.

19. Thomson, St. Clair: Cancer intrinséque du larynx; guerison durable dans 76% de cas de laryngofissure, Ann. d. mal. de l'oreille, du larynx **48**:1079 (Nov.) 1929.

with good results. Thomson advocated laryngofissure. His procedure is really partial laryngectomy or hemilaryngectomy, but is performed from the inside. All the tissues inside the thyroid ala, including the vocal process of the arytenoid, are removed. In 70 cases in which operation was performed in this way, 76 per cent of the patients were cured. There were 11 cases of local recurrence and 7 of distant metastasis. In another paper Thomson described 4 cases in which treatment was by laryngofissure, and the patients have been well for four to fourteen years.

Mackenty [20] commented on the cases of laryngeal carcinoma seen recently. In his cases there was 35 per cent recurrence with thyrotomy, so that he favors a radical operation. He does not consider biopsy desirable, but sometimes it is unavoidable. Few of the patients came to him early in the course of the disease. He operated in 10 cases in which prognosis was more hopeful. In any case in which involvement of the anterior commissure is present, laryngectomy should be performed. There were no deaths or complications following operation. Healing took place in from eleven to twenty-two days. He found that the lesion had a tendency to grow more rapidly forward and downward than upward and backward. In only 2 of the 10 cases in which operation was performed could the condition be considered as frankly intrinsic. The treatment was followed with irradiation on account of the extensiveness of the lesions. Elsewhere, Mackenty reviewed comprehensively some of the complications of laryngectomy. Hemorrhage was present in only 1 of 300 cases; the patient was a hemophiliac. Embolism occurred in 5 cases; in 4 it was fatal. A main bronchus may occasionally become blocked from secretion. Uremia and diabetes have to be guarded against, as the latter condition seems to have some relation to carcinoma and apparently increases the tendency to recurrence. Hiccup appeared in 15 cases. Pulmonary tuberculosis may infect the wound. Bronchopneumonia followed operation in only 1 or 2 cases. It is Mackenty's belief that the one-stage operation diminishes the danger of bronchopneumonia. Mediastinitis did not occur in any of his cases. Plastic defects followed in only 1 case in which the patient had had burns caused by radium; they also followed cases associated with tuberculosis or diabetes. The mortality following operation was 3 per cent and was greatest in patients aged between 75 and 81 years. In another article, 4 unusual cases were reported: 1 case was a basal cell epithelioma of the larynx of a girl, aged 20, in whom the condition was far more malignant than the histology would have led

20. Mackenty, J. E.: Analysis of Cases of Laryngeal Cancer Seen Since October, 1929, Laryngoscope **40**:740 (Oct.) 1930.

one to expect; 1 was tuberculosis and epithelioma combined, and 1 was squamous cell epithelioma, which started five years before as a benign lesion and suddenly became malignant. The change in appearance of the cords in the various phases was studied carefully. In this case embolic metastasis to the foot developed later. In the fourth case, in which there was a history of hoarseness for five years, the patient refused operation. He was treated by irradiation, and two years later laryngectomy was performed. A large portion of the esophagus had to be removed and an artificial esophagus inserted. The radium had caused considerable destruction and gangrene, and Mackenty believes that in all cases in which irradiation is used, surgical treatment should be avoided. He is firmly opposed to irradiation of any type.

One of us (G. B. N.[21]) reported unusual laryngologic conditions seen in the Mayo Clinic: mixed tumor of the pharynx, lymphosarcoma of the tongue, lipoma of the pharynx, fibrosarcoma of the hypopharynx, fibroma of the epiglottis, chondroma of the larynx, amyloid tumors of the larynx, carcinoma of the larynx in young patients and cystic hygromas of the neck.

Hautant and Ombrédanne[22] described their method of hemilaryngectomy. The treatment for intrinsic laryngeal carcinoma has been much more exact during the last ten years with an accordingly improved prognosis. Good results have been obtained in the treatment for intrinsic epithelioma by means of irradiation, especially in two types of lesions (Hautant and Coutard), namely, carcinoma of the cord without fixation, occurring early, and epidermoid epithelioma of the ventricular band. Surgical intervention is still the method of choice. The authors considered thyrotomy, total laryngectomy and conservative laryngectomy. The operation that they have used since 1925 follows these principles. They avoid the median laryngofissure with its danger of cutting through pathologic tissue and of consequent recurrence. They dissect the hemilarynx to be removed from the outside, the cavity being opened only at the end of the procedure. Healing by first intention is thus more frequent. They have found that certain portions of the larynx are practically immune to carcinoma, namely, the posterior portion of the thyroid ala of the cricoid and arytenoid. They do not remove these parts, and in this way postoperative complications in swallowing are avoided. Tracheotomy is done as a first stage and then resection of the thyroid ala and of the cricoid ring without the opening into the pĕrichondrium. The ala is divided about 0.5 cm. from the median line. The perichondrium is freed back to the posterior

21. New, G. B.: Unusual Laryngological Conditions, Laryngoscope **40**:606 (Aug.) 1930.

22. Hautant, A., and Ombrédanne, M.: Traitement chirurgical du cancer endolaryngé (l'hemilaryngectomie), Paris méd. **1**:255 (March 15) 1930.

median line, the body of the arytenoid is out, and the hemilarynx is removed in one piece with the mucosa. The wound is then packed and sutured. The pack is removed on the fourth day. If the patient is a woman, a cannula is left on account of the narrower larynx. If the epithelioma is a borderline operable case, radium is first used externally. The authors reported 65 cases in which hemilaryngectomy was performed; death occurred in 2 cases (3 per cent). Sixty-seven per cent of their patients have been well for four, three and two years.

Hajek [23] described the various methods of surgical treatment for carcinoma of the larynx and their indications. He advocated extensive laryngopharyngotomy in cases in which there is extensive involvement of the pharynx and regional lymph nodes. If the nodes are fixed to the large vessels, the operation is not advisable. Diabetes, nephritis and myocarditis are contraindications to operation. He recommended thorough preliminary asepsis of the mouth, tonsils and nasopharynx.

Canuyt [24] commented on the treatment for malignant conditions of the larynx. He advocated operation of a conservative type, if possible. He expressed the belief that laryngofissure should be done as the first stage of laryngectomy. He saves the cartilage if it is not directly involved and places a cigar-shaped pad of gauze into the larynx for fifteen days. He considers deep roentgen therapy and a radium collar valuable adjuncts later, and has not seen necrosis resulting from this treatment. In another article he commented on biopsy in carcinoma of the larynx. He does not believe that biopsy is dangerous if done immediately before operation, and considers that it should be made in all cases by the endo-oral route and only in exceptional cases by thyrotomy.

Ledoux and Sluys [25] reviewed the clinical aspects of carcinoma of the larynx. They described two systems of surgical treatment, thyrotomy and laryngectomy. Thyrotomy gives excellent results if the cases are carefully chosen. They advocated subperichondral resection of the thyroid cartilage in cases in which the anterior commissure is involved in order to cut through the diseased tissues. Laryngectomy is rarely resorted to, owing to its severity and mutilating effects. The roentgen rays and radium, although apparently theoretically ideal when used in the larynx, are not satisfactory. This is due to the comparative similarity in radiosensitivity of normal and carcinomatous tissues in the

23. Hajek, M.: Wandlungen in der Indikation der chirurgischen Larynx-Operationen beim Kehlkopfkrebs, Wien. med. Wchnschr. **80**:16, 1930.

24. Canuyt, G.: Traitement du cancer du larynx par la laryngectomie partielle et part les rayons X ou le radium, Arch. internat. de laryng. **35**:1153 (Dec.) 1929.

25. Ledoux and Sluys: Traitement des cancers épithéliaux du larynx, Cancer, Bruxelles **5**:1, 1928.

larynx. The various systems are described for applying radium to the lesion without injuring the cartilage. Two types of apparatus can be used: the packs used in America and the mold used in Europe. The best method is that of irradiation at a distance, or telecurietherapy, which would require enormous quantities of radium. By utilizing intersecting rays to the maximum, the best results can be obtained. The authors devised a special apparatus with movable tubes for this purpose. Complete operation of the radiologist and laryngologist is essential.

Lynch [26] reviewed 7 cases of hemangio-endothelioma of the larynx seen by him in twelve years. The patients were men between 30 and 45 years of age. In all cases the area involved was between the vocal process and the posterior extremity of the vocal cord, just above the free edge of the arytenoid. The only symptom was a sense of fullness. The mucosa covering the lesion was normal. On histologic examination, two types were found, the capillary and the cavernous. The tumor tends to spread forward to the vocal process, and will recur if not widely removed. Except for the tendency to recurrence, the prognosis is good.

Harmer and Finzi [27] expressed the belief that the larynx is one of the most favorable sites for treatment with radium. They cited the case of a patient who has been well for five and a half years after treatment with radium. They described their technic; they use a strong filtration. In the six years since 1925, they treated 29 patients, 26 of whom were males. They do not believe that the degree of malignancy has any connection with sensitivity to radium. In the first 14 cases the condition was too far advanced for any treatment but laryngectomy. The results were so promising that similar treatment was given in less advanced cases. In 1 case of the first group, the patient was free from disease for more than five years. Of that group, only 3 patients treated recently are still alive. Half of the patients were well for more than two years, and in all the results were palliative. The authors believe that treatment with radium is preferable to laryngectomy because of the functional results. If the lesion is still present after three months, laryngectomy should be resorted to. The second group of cases in which the condition was favorable for laryngofissure consisted of 15 patients. Eleven of these are still living after four years, and in only 2 of these was recurrence suspected. Four patients died, 2 of stenosis and later 2 of general conditions. If the growth is found to infiltrate the cartilage, it is better to use a radium collar or irradiation.

26. Lynch, R. C.: Endothelioma of the Larynx, Arch. Otol. **11**:36 (Jan.) 1930.

27. Harmer, D., and Finzi, N. S.: Radium Treatment of Intrinsic Carcinoma of the Larynx, Practitioner **124**:16 (Jan.) 1930.

THE TRACHEA

Figi [28] reported 5 cases of primary carcinoma of the trachea seen in twelve years in the Mayo Clinic. During this period, 470 carcinomas of the larynx were seen. He cited Fraenkel's statistics. The lesion is predominant in men, but in 3 of 5 of the cases seen at the clinic it occurred in women. The age varied from 29 to 77 years. Secondary involvement of the trachea is far more common. He commented on the symptoms and the course of the disease. Tickling, cough, hemorrhage, dyspnea, which varies with the change of position, and hoarseness due to involvement of the lateral laryngeal nerve may occur. Rarely is there dysphagia when the posterior wall is involved. The main cause of death is suffocation, then pneumonia, metastasis and hemorrhage. Metastasis only occurred in 1 of the cases seen at the clinic. The growth is usually highly malignant and of the squamous cell type. The diagnosis is sometimes difficult; it is usually made late in the course of the disease. The prognosis is poor, especially if the lesion is on the posterior surface, where there is no isolating cartilage. If the lesion is in the upper portion of the trachea, tracheofissure and diathermy give the best results. Excision of an upper segment of the trachea is a much more severe operation and does not give a better prognosis. If the lesion is in the thoracic portion of the trachea, the only treatment possible is with the roentgen rays and radium. The patients who have survived for one year are extremely rare. One patient treated by Bruns lived for six years. One patient treated with diathermy at the Mayo Clinic in February, 1929, had a recurrence ten weeks later, but has been well since.

Hajek [29] reported the case of a woman, aged 30, with squamous-cell epithelioma of the posterior wall of the trachea, in which treatment was by diathermy. There was no recurrence for two months.

Breslich [30] reviewed the literature on squamous cell epithelioma of the trachea. The lesions are usually near the bifurcation and are well localized. Metastasis occurs late and is rare. Carcinoma of the posterior wall is usually cylindroma, basal cell carcinoma or adenocarcinoma. In a case presented by Breslich the patient had suffered from dyspnea for two days, and from asthma, accompanied by cough and hoarseness, for six months. The carcinoma was discovered at necropsy and had metastasized to the esophagus. Breslich commented on the various theories as to the origin of this lesion.

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28. Figi, F. A.: Primary Carcinoma of the Trachea, Arch. Otol. **12**:446 (Oct.) 1930.

29. Hajek, M.: Carcinome der Trachea mittels Diathermie behandelt, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **15**:679, 1930.

30. Breslich, P. J.: Squamous Cell Carcinoma of the Trachea, J. Cancer Research **14**:144 (March) 1930.

Stenström [31] reviewed 22 cases of carcinoma of the trachea found in the literature and reported 1 case. In this case there was involvement of the recurrent laryngeal nerve on the right side with hoarseness. The tumor was at the bifurcation and was found only at necropsy.

THE ESOPHAGUS

Moersch [32] reviewed the diagnosis and treatment of carcinoma of the esophagus. This lesion represents from 5 to 12 per cent of all malignant conditions. It predominates in the male. The treatment used at the Mayo Clinic consists in dilatation with the Plummer sound. Between 1924 and 1928, 447 patients have been treated in this way. There were four deaths owing to splitting of the esophagus. The growths originating in the hypopharynx are not included in the statistics. The ratio of males to females was 7.1 : 1. The average age was 58.66 years. The patients usually see the physician late, the average time elapsing from the first signs of the disease to the visit to the physician being seven and one-tenth months. The average duration of life after dilatation was six and three-tenths months; the longest duration was twenty-nine months. Tissue was obtained in 89 of 228 cases. In 69 the condition was squamous cell epithelioma, in 17 adenocarcinoma and in 7 the condition was not classified. Patients who were treated by the roentgen rays or radium survived only four and nine-tenths months. Gastrostomy was resorted to only when unavoidable.

Seiffert [33] advocated operative treatment for esophageal carcinoma by the endoscopic route and reported a case.

Hesse [34] used diathermy in 6 cases of carcinoma of the esophagus with especially devised electrodes. Serious complications did not occur. The treatment was repeated at intervals of one or two months. Operation is not advised on account of the high mortality, and treatment with radium or the roentgen rays gives only palliative results. His results were too recent for any conclusions.

Boykin [35] reported a case of carcinoma of the esophagus and reviewed 17 cases seen since 1924; the only patient who survived the

31. Stenström, B.: Carcinome parti de la trachée et s'accompagnant de parésie du nerf récurrent droit, Acta med. Scandinav. **71**:82, 1929.

32. Moersch, H. J.: Diagnosis and Treatment of Carcinoma of the Esophagus, Minnesota Med. **12**:582 (Oct.) 1929.

33. Seiffert, A.: Operation des Oesophaguscarcinoms auf endoskopiochemische Wege, Arch. f. klin. Chir. **155**:675, 1929.

34. Hesse: Beitrag zur Behandlung des Oesophaguscarcinoms, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **15**:807, 1930.

35. Boykin, I. M.: Carcinoma of the Esophagus, S. Clin. North America **9**: 1231 (Oct.) 1929.

condition later proved to have a diverticulum. Seventy-five per cent of the patients were males.

Woodman [36] advocated the use of external cross-fire irradiation and permanent implantation of radon seeds interstitially for carcinoma of the esophagus. He treated 35 patients in this way. With this method there is no general reaction or immediate mortality. The chief objection is that only the upper part of the lesion can be treated at first, and that metastasis is not taken into account.

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36. Woodman, Musgrave: The Insertion and Use of Radon in Cancer of the Oesophagus, J. Laryng. & Otol. **44**:584 (Sept.) 1929.

Abstracts from Current Literature

Ear

GRÜNFELDER'S TOE REFLEX. Lancet **2**:1196 (Nov. 29) 1930.

This is a report of Dr. Hildegard Rothe's investigation of Grünfelder's reflex which occurs in children under 5 years of age in the early stages of acute disease of the middle ear. Before the drum has ruptured, pressure over a point at the junction of the lambdoid, occipitomastoid and parietomastoid sutures elicits in the crossed foot, i. e., the opposite foot, a dorsiflexion of the great toe and fan-shaped spreading of the other toes. In some cases it is a dorsiflexion of the great toe and a plantar flexion of the other toes, or it may be just a fan-shaped spreading of the smaller toes without any dorsiflexion of the great toe. The reflex is supposed to be due to the increased pressure in the middle ear and is therefore less frequently present after the drum has ruptured.

McNALLY, Montreal.

MODIFIED RESONANCE THEORY FOR PERCEPTION OF ULTRAMUSICAL TONES AND OF NOISES. F. LEIRI, Arch. f. Ohrenh-, Nasen- u. Kehlkopfh. **128**:12 (Feb. 28) 1931.

Leiri first directs attention to his former publications on the perception of ultramusical tones, in which he expressed the opinion that ultramusical tones as well as the nonperiodic oscillations of noises are transmitted to the auditory cells by oscillations of the basilar fibers. Some investigators have questioned the possibility of oscillations of the basilar fibers, because they are embedded in a layer of tissue. However, the author shows that the fact that the basilar fibers are embedded in the membrana basilaris does not inhibit their oscillations, but rather facilitates them for sounds the oscillatory frequency of which is close to the frequency of the fibers.

EDITOR'S ABSTRACT.

BEHAVIOR OF THE MUCOUS MEMBRANE OF THE MIDDLE EAR FOLLOWING RADICAL OPERATION. H. BRUNNER, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**:28 (Feb. 28) 1931.

Brunner reports his observations on nine cases. The conditions described in the operative cavities apply specifically to the cases under observation and do not permit immediate generalizations. However, on the basis of these studies and of the reports in the literature, the author reaches the following conclusions: 1. Epidermization of the antrum and attic takes place comparatively late. In the tympanic cavity, it commences earlier. This is also the case when a cholesteatoma is not present. 2. The epidermization of the tympanic cavity is closely related to the lower remaining portion of the tympanic membrane, which is usually present, even if it appears as if the tympanic membrane were totally destroyed. 3. The remainder of the tympanic membrane may develop into a polypus, on the surface of which the epidermis grows into the middle ear. More frequently, the remainder of the tympanic membrane grows with the mucous membrane of the promontory of the tympanum and thus shuts off the lower portion of the tympanum from the upper portion. 4. The lower portion of the tympanum can be of varying extension; it may or may not inclose the fenestra rotunda, and it may communicate with the tube, which is more often the case. 5. The lower portion of the tympanum does not become epidermized, and the epidermis bridges this space. 6. The epidermization of the antrum and attic takes place so that the granulation tissues grow out of the opened medullary spaces. Underneath the epidermis, the granulation tissue forms either a thick or a thin layer of connective tissue. Moreover, the attic, as far as it is still present, is usually completely filled

with connective tissue, the lower surface of which is covered by the epidermis. 7. In cases in which the middle ear has been curetted on account of cholesteatoma, the stage of epidermization is preceded by a stage in which the existing epidermis is cast off, the mucous membrane is without epithelium and a layer of connective tissue covers the bone. The question as to whether the matrix should be completely destroyed in cholesteatoma is therefore irrelevant, because a complete destruction of the matrix is technically impossible; the author does not think that it is necessary. 8. Complete recovery is almost never effected, for it would be necessary for the epidermis that covers a thin layer of connective tissue to cover all of the surfaces of the bone. Even in cases in which it appears as if the operative cavity is healed, it is usually not so, because in the majority of such cases granulation tissues and cysts are found underneath the epidermis, and frequently the cysts contain pus. 9. The prognosis likewise is unfavorable if fragments of mucous membrane remain in the middle ear after the operation. If this is the case, large polypi may form and suppurations may continue. 10. The condition of the soft parts of the operative cavity does not permit inference in regard to the condition of the bony walls. Even if suppurative processes exist in the operative cavity, the bones may be healthy; on the other hand, osteoclasts may exist under an intact epidermis. 11. However, it is possible that the granulation tissues that form in the antrum and attic soon after the operation may attack the bony walls and form new otitic foci. 12. An occlusion of the tube in which the tympanal orifice is separated from the middle ear by a membrane and opens into a cystic cavity, which is lined with cylindric epithelium, is favorable for the prognosis.

EDITOR'S ABSTRACT.

VERTICAL NYSTAGMUS. S. H. MYGIND, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**: 69 (Feb. 28) 1931.

Mygind reports observations that disprove the generally accepted theory that vertical or diagonal nystagmus is always caused centrally and indicates intracranial complications. He found that vertical or diagonal nystagmus is especially frequent in collateral edema of the labyrinth, which often accompanies suppurations of the middle ear. In patients with Ménière's disease it was observed that the spontaneous nystagmus was more or less vertical in nearly 50 per cent of the cases. It was also noted that the various types of fistulous symptoms may cause a vertical nystagmus. The author comes to the conclusion that a vertical or diagonal nystagmus is not a sign of an intracranial disorder, even when it occurs in patients with intracranial processes, for it is possible that in such cases it may be caused indirectly by the labyrinth.

EDITOR'S ABSTRACT.

SECONDARY PLASTIC CLOSURE OF ANTROTOMY WOUNDS. M. SVERAK, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**:73 (Feb. 28) 1931.

Maria Sverak discusses the various methods of after-treatment following opening of the mastoid process. Open wound treatment by means of tamponade, which effects gradual closure of the operative defect by granulation, is still practiced by some otologists; others recommend primary closure, but the observation that the infection of the antrotomy wound can be overcome by open treatment has led to the practice of secondary closure. The author further reviews the various methods that have been recommended to fill the defects resulting from the operation on the mastoid process, and then describes a procedure in which the following preparation is employed: 9.3 per cent of centrifugated, sterile beef plasma, 3.5 per cent of a 1:10 solution of sodium citrate, 0.2 per cent of a quinoline derivative and a 4.5 per cent solution of calcium chloride, which serves as an activating liquid. The simple technic of this method is described, and the author cites fourteen cases in which this preparation was employed for the secondary plastic closure of antrotomy wounds. This technic was employed on an average of about nineteen days after the antrotomy; the time required for healing averaged eleven

days. For the success of this method it is essential that the wound is free from bacteria and that the plastic material is absolutely fresh. A plastic operation in which this preparation is used is not advisable in cases with endocranial complications, in children with exudative diathesis or in patients with metabolic disturbances, such as diabetes; otherwise, it may be employed for patients of all ages. Even repeated application of the preparation does not result in anaphylaxis. The author thinks that the favorable results of this method justify further application.

EDITOR'S ABSTRACT.

MÉNIÈRE'S SYNDROME. M. KRASSNIG, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**:141 (Feb. 28) 1931.

Following a review of the different theories of the etiology of Ménière's syndrome, Krassnig shows why the most widely accepted theory, namely, that Ménière's syndrome is caused by angioneurotic disturbances, is not satisfactory. His further discussions are based on observations on fifty patients with Ménière's disease. He divides these cases into two groups. To the first group belong eighteen patients in whom Ménière's syndrome was caused by such conditions as syphilis of the labyrinth, meningitis, circumscribed labyrinthitis, tumors of the acoustic nerve and encephalitis. These cases prove that typical Ménière's symptoms may be caused by anatomic lesions. Of greater interest from the standpoint of etiology are the other thirty-two cases, in which anatomic changes could not be detected. The author's observations on these patients are summed up as follows: 1. In nearly all of these patients catarrhal changes existed in the auditory tube and frequently also in the middle ear. The simultaneously existing auditory disturbances could generally be traced to the diseased condition of the tube. The disorders of the vestibule and of the cochlea could be influenced favorably and probably also causally by the usual therapy. 2. On the basis of careful clinical observations, it appears probable that not only the changes in the tube but the inflammatory processes in the tensor muscle are significant for the etiology. 3. The supposed tensor disturbances accord with that which is known or assumed about the tensor function and about the pressure fluctuations in the labyrinth. 4. The cases of Ménière's disease reported in the literature do not contradict this theory. 5. It is possible that Ménière's syndrome has other causal factors; however, the author thinks that the majority of cases are caused by the conditions that he describes.

EDITOR'S ABSTRACT.

CASES OF LABYRINTHITIS COMPLICATING ACUTE OTITIS MEDIA. V. HINSBERG, Monatschr. f. Ohrenh. **64**:1263 (Nov.) 1930.

In three of Hinsberg's ten cases, labyrinthitis developed during the serous stage of otitis media and in two during the suppurative stage from one to four weeks after perforation of the tympanic membrane had occurred. In five cases, labyrinthitis started when the otitis media was of over five weeks' standing. In one instance, the otitis media presented a mild form; in three, the onset was violent. In one instance, suppuration had already disappeared when the labyrinth became invaded. In five instances, the course of the otitis media was chronic. In two cases, labyrinthitis developed on the second day of otitis media; in four cases, on the third, tenth, eighteenth and twenty-first day, respectively, and in four cases, in the fifth, sixth, eighth and thirteenth week, respectively. In two cases, labyrinthitis appeared at the third day after antrotomy, and in one case, a day after attico-antrotomy have been performed. No connection was found between the operation and the labyrinthitis. The signs of labyrinthine irritation were pronounced. In one patient, the labyrinthine disease started with an intense vestibular irritation. Ten days later, both ears became deaf; this was followed by a lateral nystagmus ten hours afterward. Evidently the infection had spread through the two fenestra rotunda and therefore first the cochlea and then the vestibule and the semicircular canals became involved. In four cases, the labyrinthitis was serous, and in the remainder it was purulent. An inflammation of

the hemorrhagicopurulent type was found on microscopic examination in one case thus examined. Eight patients died with signs of meningitis. One of them suffered with diabetes and another with diabetes and nephritis. One patient who had not developed meningitis recovered; another with meningitis was cured by an operation on the labyrinth and repeated lumbar punctures. Hinsberg ascribes the high mortality to the expectant treatment based on the theory that in cases of acute otitis media an operation on the labyrinth ought to be avoided. Hence he is inclined to agree with authors who think that an operation should be tried in such cases as well as in cases of chronic otitis media.

EDITOR'S ABSTRACT.

SPONTANEOUS NYSTAGMUS AND INFLAMMATION OF THE LABYRINTH. W. KLESTADT, Monatschr. f. Ohrenh. **64**:1294 (Nov.) 1930.

Cases of labyrinthitis are described in which a spontaneous nystagmus directed to the left and to the right or one with an alternate direction was combined with a nystagmus developing on changes in posture of the head. These were cases of a circumscribed or diffuse serous labyrinthitis. In cases in which endocranial signs were absent, the posture nystagmus was of peripheral origin. The clinical picture appeared complicated, because there is a mutual and simultaneous irritation of the sensory endings in such cases. Klestadt warns that a spontaneous nystagmus with an alternate direction can be confounded with a posture nystagmus. Two cases of serous labyrinthitis are reported in which a posture nystagmus induced by a peripheral vestibular disease was associated with a bilateral and alternate spontaneous nystagmus. Posture nystagmus was found in a case which presented the characteristics of a circumscribed labyrinthitis. In two other cases, changes in the initial direction of a spontaneous nystagmus were brought about by further progression of the labyrinthitis.

EDITOR'S ABSTRACT.

DIAGNOSTIC ERRORS IN CASES OF OTOMYCOSIS. E. CAVADAS, Monatschr. f. Ohrenh. **64**:1302 (Nov.) 1930.

Five of Cavadas's cases occurred in women and one in a man. In one instance, the patient had suffered with a suppurative otitis media for which he had been treated by radical operation ten years before. Attacks of dizziness accompanied by vomiting developed twenty days prior to admission to the hospital. The facts that the hearing was intact and that there was no fever indicated that there was irritation of the labyrinth only. The disturbances yielded to instillations of "Salizylspiritus" (composition not given by author). Three years later, dizziness and buzzing in the diseased ear reappeared. On examination, the auricular cavity proved to be filled with fungous masses, large as hazelnuts and covered with a blackish-gray discharge. The pathologic phenomena disappeared after treatment with "Salizylspiritus." In another case, pain, discharge and buzzing in one ear lasted for two months. On examination, swelling of the auditory meatus and inflammation of the tympanic membrane were found. The walls of the meatus appeared covered with a discharge; the presence therein of greenish spots the size of a pinhead suggested the diagnosis of otomycosis. The third patient was affected with intense pain, buzzing and discharge in one ear for about a year. A serous blackish discharge was found in the ear; the tympanic membrane appeared inflamed and partly covered with gray membranes. Gray masses of mold myceliums were located in the external auditory meatus. The pathologic manifestations disappeared after three days of treatment with instillations of "Salizylspiritus." In the fourth patient, the disease started with severe pain and swelling of the external auditory meatus and auricle. Fungous masses and a serous discharge were found in the external auditory meatus. Two days later, the swelling vanished and the tympanic membrane then appeared to be inflamed and covered by ash-gray membranes. The latter were repeatedly removed. Recovery was complete. Difficulty of hearing and buzzing persisted for about a month after recovery. In the fifth patient, the condition was previously treated as an eczema. On admission, signs of otitis

externa were found; the tympanic membrane appeared intact. The presence of a blackish discharge indicated the diagnosis of otomycosis. In the sixth case, the disease started with pain and discharge in the ear and attacks of dizziness. White fungi were found in the discharge; the tympanic membrane appeared inflamed. The diagnosis of otomycosis was confirmed on cultures and microscopic examination. In all cases, *Aspergillus niger* and *Aspergillus fumigatus* proved to be the causal agents of the disease. The treatment, consisting exclusively of instillations of "Salizylspiritus," was continued for about a month after all pathologic manifestations disappeared. No recurrences were observed. The author stresses the fact that otomycosis can be easily mistaken for acute otitis media when the fungi are located on the tympanic membrane, or for a labyrinthine or cerebral disease when the otomycosis develops in a patient with suppurative otitis media or with a perforated tympanic membrane. Otomycosis may be mistaken for a furuncle of the external auditory canal, eczema or cholesteatoma. The differentiation from a suppurative otitis media is difficult in the initial phase of otomycosis when the fungi are whitish and colored conidia have not yet developed.

EDITOR'S ABSTRACT.

A CASE OF RARE CONGENITAL DEFORMITIES. L. HOFMANN, Monatschr. f. Ohrenh. **64**:1412 (Dec.) 1930.

A case of a rare congenital deformity was observed in a premature boy who died soon after birth. On the right side, a pronounced hypoplasia of the external ear with atresia of the auditory meatus, atresia of the middle ear and absence of the auditory ossicles was noted, and also absence of the stapedius muscle and the facial canal. The cartilage of the branchial arch persisted; it was deformed. Besides there were a persisting vena capitis lateralis, a slight deformity of the internal ear, especially of the cochlea, hydrops of the labyrinth, malformation of the lower jaw and absence of the zygomatic process. On the left side, a slight hydrops of the labyrinth and pronounced otitis media were present. Moreover, there was a defect in the ventricular septum of the heart. The lobes were not differentiated in the right lung, while the left lung presented three lobes.

EDITOR'S ABSTRACT.

NEW THEORY CONCERNING THE MECHANISM OF HEARING. W. L. FRIEDMANN, Monatschr. f. Ohrenh. **64**:1468 (Dec.) 1930; **65**:313 (March) 1931.

Friedmann states that the fundamental difference between his new theory of sound perception and the generally accepted theory of Helmholtz is that he ascribes the main rôle in the conduction of sound toward the ends of the auditory nerves to the molecules of the hidden gases that are dissolved in the labyrinthine fluid of the cochlea and that are also present in the other tissues (bones and blood) on the track to the labyrinth. It is known that at a temperature of 0 C. (32 F.) and under a pressure of 760 mm., 60 cc. of gases may be extracted from 100 cc. of blood. These gases consist of oxygen, nitrogen and of carbon dioxide, and they are present in all the tissues of one's organism. Their pressure is equal to the atmospheric pressure. The author states that he arrived at his new theory of sound perception on the basis of the latest observations on the physiology and pathology of the hearing process, which cannot be explained by Helmholtz' theory; for instance, the fact of the unequal susceptibility of the ear to the different sounds. The maximum susceptibility is for sounds with approximately 2,300 vibrations, whereas sounds with a low frequency of about 100 vibrations cannot be differentiated. Another observation, which cannot be explained by the older theory of the rôle of the sound conduction apparatus, is that high sounds do not require the mediation of the tympanic membrane and of the auditory ossicles, for in chronic diseases of the middle ear the susceptibility for high sounds is only slightly impaired. As to the reason why the ear is most susceptible to sounds with a frequency of about 2,300, the author assumes that this frequency is close to that of the molecules of gas in the cochlea, and he also thinks that the specific adequate

stimulation of the terminations of the auditory nerve in Corti's organ are the vibrations of the molecules of gas in the labyrinthine fluid. The author considers tinnitus aurium as the result of a disturbance in the equilibrium between the molecules of gas in the blood and those in the tissues. The fact that tinnitus aurium generally corresponds to high sounds is in accordance with the assumption that the vibrations in the cochlea are within the region of the higher sounds. The author asserts that his theory does not contradict the well known fact that the majority of sounds cause vibrations of the tympanic membrane and of the auditory ossicles. However, he thinks that these vibrations of the sound conduction apparatus cannot be visualized without the simultaneous vibrations of the molecules of gas. He comes to the conclusion that the sound conduction apparatus is of significance only for the acuity of hearing or for the quantity capacity and only for low sounds. As the essential and absolutely necessary element of the act of hearing, he considers the molecular vibration of the gases in the cochlea. He points out that otologists have long been aware of the fact that the conduction apparatus plays only a secondary rôle in the act of hearing, for if they are consulted by a patient who is not able to understand even loud talking, they know before examination that the disturbance affects the nervous apparatus.

EDITOR'S ABSTRACT.

THERAPY OF OTOGENIC MENINGITIS. E. RUTTIN, Monatschr. f. Ohrenh. **65:** 257 (March) 1931.

Ruttin asserts that of all the otogenic complications meningitis has the most unfavorable prognosis. However, he thinks that in the last two decades the possibilities for recovery in otogenic meningitis have become more favorable. This is due to three factors: better diagnostic methods, better surgical technic and simultaneous medicinal therapy. The author describes the clinical histories of four cases, which are of significance in regard to these three factors. In the first case there were diagnostic difficulties as it was doubtful whether the patient had a tuberculous or an otogenic meningitis. Before the labyrinthitis had been recognized as the cause, the assumption of the tuberculous character of the meningitis had induced an internist to institute intralumbar injections of a gold preparation (solganol). These injections were continued following the operation on the labyrinth. As the result of the combined medicinal and surgical treatment, the patient recovered. This success induced the author to combine the intralumbar injections with the radical operative treatment in other cases of otogenic meningitis. It appeared advisable to withdraw considerable quantities of the suppurative cerebrospinal fluid, and in order not to reduce the pressure too much, to replace it by another fluid. Accordingly, 20 cc. of cerebrospinal fluid was withdrawn every second day and was then replaced by 10 cc. of a physiologic solution of sodium chloride with 0.01 of the gold compound. Since Neumann had obtained favorable results in otogenic meningitis with intravenous injections of a methenamine-sodium salicylate preparation (cyloptropin), the author combined this treatment with the foregoing one by giving intravenous injections of 5 cc. of the methenamine-sodium salicylate preparation on the days when lumbar puncture was not done. One of the four patients received treatment with the gold compound only, while in the other three cases the combined medicinal therapy was used. This treatment was, of course, only an adjuvant to the radical operative procedure. Three patients recovered and one died. The author considers early and radical operative treatment as the most important factor in the treatment of otogenic meningitis. He also points out that labyrinthogenic meningitis may be prevented by early operative treatment of the labyrinth.

EDITOR'S ABSTRACT.

TRANSLABYRINTHINE OPERATION ON TUMORS OF CEREBELLOPONTILE ANGLE. GÜTTICH, Monatschr. f. Ohrenh. **65:**272 (March) 1931.

Güttich evaluates the various operative methods that have been recommended for the treatment of tumors of the cerebellopontile angle, particularly the trans-

labyrinthine method. He points out that this procedure is not yet perfect and still needs to be improved. Its application should be limited to the cases in which the general cerebral disturbances are not yet too severe. In order to be able to decide this, it is advisable to examine the healthy ear carefully. If in this ear the cochlea or the vestibule show degenerative changes, the cerebral pressure is generally considerable. For a patient who is not able to walk or stand up, the translabyrinthine operation is not advisable, because chiseling on the hard petrous portion of the temporal bone is too dangerous. However, in a patient who is in a good general condition, the translabyrinthine operation may be attempted. Particularly advisable is this method in patients in whom the beginning of the acusticus tumor can be recognized in the roentgenogram on the dilation of the porus internus. In other methods of operation, the tumors in the lumen of the internal auditory meatus may easily be overlooked. The main objection to the translabyrinthine operation is that it involves danger of infection from the middle ear or from the tube. But the author considers this as unfounded. The second objection is that of the danger of hemorrhage during the operation. The author thinks that this can be avoided. The main advantage of the translabyrinthine method over other operations, especially over Krause's occipital procedure, is that the cerebral substance does not have to be pushed aside. The author also mentions Borchard's method, which is a combination of the labyrinthine and the occipital methods. It has been employed only once by Borchard. Later he adopted Krause's procedure, that is, exposure by way of the occiput. It is pointed out that Krause's method is sometimes wrongly ascribed to Cushing. Specht recommends a modification of Borchard's procedure. The new aspect of Specht's method is that he avoids radical operation of the middle ear and by this preserves the facialis. In the conclusion, the author states that in certain cases, which he designates, the translabyrinthine treatment should be attempted. If difficulties arise during the operation, occipital exposure can be resorted to, that is Borchard's method can be followed.

EDITOR'S ABSTRACT.

Pharynx

SUDDEN DEATH FROM HYPERPLASIA OF LINGUAL TONSIL. MAVILLE and SOUTTER, Ann. de méd. lég. **10**:573, 1930.

The case is reported of a man, aged 25, with chronic alcoholism, who was known to have died suddenly and quietly in his sleep. , He had suffered from attacks of dyspnea and choking associated with retrosternal and epigastric pain for years, one such attack shortly preceding death.

At necropsy, in addition to marked hypertrophy of the lingual tonsil and hypertrophy of the palatine tonsils and of the lymphatic tissue adjacent to the epiglottis and the larynx, there were islands of hyperplastic lymphatic tissue in the omentum and mesentery. Multiple hemorrhages were visible microscopically in the adenoid tissue of the pharynx. There was no lymphatic hyperplasia in the spleen, thymus or follicles of the large intestine. A plug of mucus obstructed the larynx. The other organs were normal.

Death appeared to be due to asphyxia brought on by the lesions in the throat: (*a*) mechanically, from obstruction, (*b*) reflexly, by laryngeal irritation, (*c*) by cardiospiratory failure due to possible excessive swallowing of air associated with the condition of the throat, or (*d*) in association with one of the lymphatic diatheses in which sudden cardiac deaths are frequent. [ARCH. PATH.]

TONSILLECTOMY IN DIPHTHERIA CARRIERS. A. WERNER, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**:115 (Feb. 28) 1931.

A review of the literature on the disinfection of diphtheria carriers convinced Werner that tonsillectomy has not received the attention its effectiveness deserves. He states that in the otolaryngologic clinic in Zürich tonsillectomy was performed

on seventeen diphtheria carriers. In all of these patients the anamnesis revealed previous tonsillar disturbances, which seem to produce in these patients a predisposition to become carriers. Because the usual therapy did not effect disinfection, tonsillectomy was performed. The postoperative course was always normal. The results justify the following conclusions: 1. The disinfection of diphtheria carriers constitutes one of the most important factors in the prophylaxis for diphtheria. 2. Tonsillectomy is the quickest and most reliable method of disinfection. 3. If regular control reveals the persistence of the diphtheria bacilli and if the test for virulence gives a positive reaction, tonsillectomy may be performed after the fifth week following the disappearance of the clinical symptoms of the disease. Tonsillectomy is not dangerous for the patient, but is advantageous for him and for the public. 4. The occurrence of diphtheria bacilli in the nose or the presence of adenoids which may harbor bacilli may defeat the aim of the tonsillectomy. For this reason, adenoids should also be removed, and in every diphtheria carrier tonsillectomy should be preceded by a careful examination of the retronasal space, and smears should be taken from the nose and from the nasopharynx. 5. Tonsillotomy is not sufficient for disinfection. Even in children who are diphtheria carriers the tonsils should be completely enucleated. 6. A newly tonsillectomized diphtheria carrier cannot be considered as entirely free from the bacilli until at least ten days have passed. After the operation, smears should be taken and examined regularly. When three successive smears from the pharnx and nose, made after intervals of five days, have been found to be negative, the patient may be considered completely disinfected.

EDITOR'S ABSTRACT.

CONGENITAL ANOMALIES ORIGINATING FROM THE SECOND BRANCHIAL ARCH. E. GLAS, Monatschr. f. Ohrenh. **64**:1307 (Nov.) 1930.

During his researches on tuberculous tonsils, Glas had found cartilage and bone in the connective tissue of some tonsils. In one case, that of a man, aged 35, enucleation of both tonsils was performed on account of repeated abscesses in the throat. Cartilage and bone tissues were situated deep in both tonsils. Histologic examination indicated the presence of strips of bone in the capsule, the connective septums and the lymphadenoid tissue of the tonsils. The bone tissue proved to develop from islets of cartilage. Similar islets of cartilage were located behind both auricles. The cartilage as well as the bone tissue had evidently developed from the second branchial arch; they were not metaplastic. Two cases are discussed in which a congenital fissure was present in the anterior palatine arch and the upper poles of the tonsils were absent. The absence of the palatoglossus muscle testified to the congenital origin of the defects. A case of congenital syphilis was observed in which the anterior and posterior nasal orifices were obturated and the uvula was absent; in addition there was a marked demarcation between the mesopharynx and the epipharynx on both sides and an absence of lymphatic tissue in the faucial ring. In another case, the styloid process was situated within the left tonsil. The pathologic signs consisted of a feeling of a foreign body, tension in the tonsil and pain radiating to the left ear. Again the anomaly was connected with the second branchial arch. The last observation is concerned with congenital cervical fistulas on both sides, the internal opening of which was located at the pharyngopalatine arch and the external opening at the anterior margin of the sternocleidomastoid. The anomaly was evidently associated with a deficient development of the second branchial cleft.

EDITOR'S ABSTRACT.

CASES OF PRIMARY AND SECONDARY TUBERCULOSIS OF THE TONSILS. A. von TÓTH, Monatschr. f. Ohrenh. **64**:1315 (Nov.) 1930.

In one of von Tóth's cases a cheesy detritus was present in one tonsil and no similar lesions were located elsewhere; this was found at necropsy on a girl, aged 10, who died of typhoid fever. Histologic examination indicated the presence

of a few tubercles beneath the epithelium and within the tonsillar tissue. Evidently the tubercle bacilli had penetrated with foods or through the air. Exhaustion of the organism from the typhoid disease favored development of the tuberculous process. In eleven cases of tuberculous basilar meningitis, association of miliary tuberculosis was observed in six; the tonsils were involved in all except one. In one of these cases numerous tubercles were found only in one tonsil. The fact that the tonsillar process appeared to be advanced suggested that the tonsil was primarily infected and the meninges secondarily. In seven of eight cases of generalized miliary tuberculosis, both tonsils were involved; the invasion of the bacilli might have occurred through the blood stream. Tuberculous lesions of the tonsils were present in one of seven patients with a mild pulmonary tuberculosis. As tonsillectomy and adenotomy proved effective in cases of scrofulosis or of latent tuberculosis, the author performed these operations in eighty-one cases of a phlyctenular disease of the eyes. Improvement occurred in twenty-seven cases and complete recovery in twenty-nine. Tubercles of the tonsils were found in three of four cases of advanced pulmonary tuberculosis. The infection appeared to be transmitted from the lungs by way of the blood stream. There was involvement of the larynx in six of fifteen cases of generalized tuberculosis. In six instances, the tuberculous process developed also in the tonsils coexisting with laryngeal tuberculosis in four. Since the miliary tubercles were located beneath the epithelium, the infection evidently was carried by the sputum. Thus of a hundred patients examined, tuberculosis of the tonsils was observed in nineteen; in sixteen instances, the process was bilateral, and in three it was unilateral. The infection was primary in two. Tonsillar tuberculosis was not found in patients under 2 years of age or over 55. The prognosis of tonsillar tuberculosis is grave on account of the menacing extension of the infection. Tóth emphasizes the fact that in cases of tonsillar tuberculosis clinical symptoms and macroscopic changes may be absent.

EDITOR'S ABSTRACT.

DRY MUCOSAL CATARRH AND PHARYNGITIS SICCA. H. MARSCHIK, Monatschr. f. Ohrenh. **64**:1381 (Dec.) 1930.

Marschik discusses the question whether a deficient functioning of the glands or changes in the composition of the secretion are responsible for a dry catarrh of the upper respiratory tract. His conclusion is based on the fact that a reduced secretion and atrophy of the glands are observed in chronic catarrh, but such atrophy does not occur in cases of acute catarrh in which hyperemia and exaggerated glandular secretion are present. Evidently changes in the composition of the secretion are the causal factor of a dry catarrh. The changes are of bacterial or exogenous origin in cases of acute catarrh accompanying, among other conditions, influenza, typhoid, certain forms of septicemia, the terminal stage of tuberculosis, Addison's disease and cachexia. The dry catarrh is of nonspecific or endogenous origin when it occurs after tonsillectomy or develops as an occupational disease, for instance, in workers manipulating fire.

EDITOR'S ABSTRACT.

Nose

OPERATIVE TREATMENT OF ACUTE AND CHRONIC SUPPURATIONS OF THE MAXILLARY SINUS. J. KOCH, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**:16, (Feb. 28) 1931.

Koch first evaluates the various operative methods that have been recommended in the treatment for acute and chronic suppurations of the maxillary sinus. The disadvantage of the different radical operations, whether they are facionasal or endonasal, is that they frequently cause injuries to the teeth. It was therefore the author's aim to effect a wide opening of the maxillary sinus from the lower nasal duct by a minor and simple intervention. His method is similar to that described by Ruttin, only he uses a drill and a punch instead of a chisel. Following anesthetization of the lower concha and of the lateral wall of the lower nasal duct, the maxillary sinus is opened by means of the drill at the level of the head

of the lower concha. The sinus is then irrigated by means of the tube surrounding the drill, and following this a large portion of the lateral wall of the lower nasal duct is removed with a slender punch. This procedure is followed by irrigation and by tamponade of the entrance to the maxillary sinus. On the day following the operation, the nasal tampon is removed, and the maxillary sinus is again irrigated. Thereafter, irrigations are done every day, and a strip saturated with a menthol boracic ointment is introduced into the operative opening and into the lower nasal duct. Half an hour later, the patient can remove the strip. This treatment was employed in thirty operations on twenty-three patients, namely, in ten cases of acute and in twenty cases of chronic suppuration. The author recommends this simple endonasal intervention for acute disorders of the maxillary sinus with signs of severe congestion. In acute suppurations, if crumbling pus indicates a beginning necrosis of the mucous membrane, the opening of the sinus from the lower nasal duct will prevent the development of a chronic condition. This method is also helpful in chronic suppurations of the maxillary sinus, and it should be employed whenever irrigation has failed and a radical operation is either declined by the patient or does not seem advisable for social reasons. However, Denker's operation brings quicker and better results in chronic conditions, and the author recommends this operation in chronic cases whenever possible. The cases in which the author treated the patients by the method described also proved that scraping of the mucous membrane is not absolutely necessary for the cure of a suppuration of the maxillary sinus. Even chronic inflammatory changes of the mucous membrane can often be counteracted by relief from the secretion and the production of a proper discharge. An occlusion of the operative opening by granulations is not to be feared, provided a sufficient portion of the bony nasal duct is removed. Careful attention should be given to simultaneously existing disorders of the ethmoid, frontal and sphenoidal sinuses, which may prevent healing of the maxillary sinus on which operation has been performed. The opening from the lower nasal duct is not advisable in case of cameration of the maxillary sinuses and also in hyperplastic and polypous changes of the mucous membrane. In such cases and when endocranial and orbital complications exist, a facionasal radical operation will be necessary.

EDITOR'S ABSTRACT.

METHOD AND RESULTS OF INJECTIONS OF IODIZED SESAME OIL 40 PER CENT FOR ROENTGENOGRAPHY OF THE ACCESSORY CAVITIES. H. STERNBERG and L. SATZ, Monatschr. f. Ohrenh. **64**:1384 (Dec.) 1930.

Sternberg and Satz describe the method in which a 10 per cent oil solution of iodized sesame oil 40 per cent is used for roentgenography of the accessory sinuses. Their experience includes twenty-five cases of vasomotor rhinitis or antritis catarrhalis. Cases in which a purulent discharge was present in the accessory cavities were excluded. In ten cases, the filling of the sphenoid sinus with the contrast substance proved to be complete; in six it was partial, and in nine the result was negative. The filling appeared positive in patients in whom vasomotor rhinitis was accompanied by an excessive watery discharge. There was no swelling of the nasal mucosa or accessory cavities; the aperture of the sinus remained unchanged. The filling of the sphenoid sinus proved to be incomplete or failed when the nasal mucosa and probably that of the sinus were swollen and the size of the aperture was thus reduced. The filling of the ethmoid sinus was complete or partial in fifteen instances; the posterior portion of the sinus was most frequently filled when the result was partial. The iodized oil appeared to penetrate the frontal sinuses after the ethmoid sinus was filled. Penetration of the iodized oil into the nasopharynx enabled a roentgenologic examination of the epipharynx; thus adenoids or tumors could be demonstrated. The authors point out that the injection of iodized oil was usually followed by disappearance of the nasal discharge and by subsidence or improvement of the headache. Only in some instances have the disturbances recurred.

EDITOR'S ABSTRACT.

Miscellaneous

OPHTHALMOLOGIC ASPECTS OF CRANIAL SINUS THROMBOSIS. W. L. BENEDICT, Proc. Staff Meet., Mayo Clin. **5**:367 (Dec.) 1930.

The usual conditions observed around the orbit as a result of thrombosis of the great venous sinuses of the head are exophthalmos, edema of the orbit and lids, progressive external ophthalmoplegia with faulty ocular rotation, nystagmus, pupillary phenomena, dimming of vision, disturbances of retinal circulation and changes in the optic nerve head. As many of the changes may be brought about by other causes, a differential diagnosis should be made by one who has had considerable experience in ophthalmic practice, if a proper evaluation of ocular changes is desired.

Thrombosis of the cavernous sinus is usually first suspected after the appearance of swelling of the lids with proptosis, and when signs of septicemia have appeared in a case of infection about the head. Fever, malaise, headache, disturbances of motility of the eye, proptosis and sometimes visual disturbances are present. Examination of the retina may show that the veins are engorged, but often only after other symptoms have been present for two or three days. Motor disturbances are caused by pressure on the third, fourth and sixth nerves as they pass through the sinus.. Choked disk results from obstruction to the flow from the central vein. Local diseases within the orbit, such as cellulitis, tumor and tenonitis, may cause similar symptoms. Unilaterality of symptoms is helpful in differentiation. In most cases of thrombosis of the cavernous sinus the condition is bilateral.

Thrombosis of the lateral sinus causes changes about the eyes in less than 10 per cent of the cases observed. Choked disk is the most commonly observed change, and it occurs only when intracranial extension takes place, such as meningitis, abscess or extension of the thrombosis to the sinuses. Choked disks have been reported in cases of disease of the mastoids without sinus thrombosis or other signs of intradural involvement.

With the knowledge that choked disk may occur in surgical disease of the mastoids, with or without thrombosis of the lateral sinuses, the only conclusion that one can reach regarding the condition is that some unknown intracranial involvement has taken place. Probably the gravity of the situation is heightened if choked disk follows frank septic phlebitis of the sinuses. In more than 100 cases of septic phlebitis of the sinuses observed on Dr. Lillie's service, less than 10 per cent showed changes in the fundus. Progressive choked disk has been found only when the patients were extremely ill and the illness went on to a fatal termination.

Thrombosis of the longitudinal sinus was found in 15 cases in which the fundus was also examined. In none of this group was there anything about the eyes to suggest thrombosis except the dilatation of the veins over the lids and forehead, as mentioned by Doyle, and this was noted in only 1 case. In the absence of tumor of the brain or involvement of the cavernous sinus, choked disk was not observed in this group of cases.

W. ZENTMAYER, Philadelphia.

A MODIFICATION IN TRACHEOTOMY. H. G. B. RUSSELL, Brit. M. J. **2**:594 (Oct. 11) 1930.

The author advocates passing an intratracheal catheter via the nose according to the method of Magill, i. e., without the assistance of vision and by using local instead of general anesthesia. The nose is first sprayed with a 10 per cent solution of cocaine containing a drop of 1:1,000 epinephrine. A number 12 Porges catheter mounted on a stylet is bent into the form of a capital C, the tip being slightly bent forward, and the catheter is passed into the nose; it finds its way through the pharynx into the larynx, "the operator being guided largely by the intensity of the respiratory sounds heard at the proximal end of the catheter." In his experience the author says the method is very easy of application and he

recommends it as a preliminary to emergency tracheotomy for acute laryngeal obstruction. It is also suggested as a preliminary to intratracheal gas anesthesia for operations on the throat as it does away with ether for the intubation.

McNALLY, Montreal.

TUMOR OF THE BRAIN AND TRAUMA. R. NUSSBAUM, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**:129 (Feb. 28) 1931.

Nussbaum first reviews the literature on the correlation between trauma and tumor of the brain. The review indicates that opinions differ. The investigators who consider a relation possible are of the opinion that the trauma has to be of considerable severity in order to lead to the development of a tumor. In the second part of the article the author describes a case in which he rendered expert testimony as to whether the cerebral tumor (glioma) could have been caused by trauma. He came to a negative conclusion.

EDITOR'S ABSTRACT.

TREATMENT OF PULMONARY ABSCESSES WITH INTRATRACHEAL INJECTIONS. N. A. ILJASCHENKO, Monatschr. f. Ohrenh. **64**:1340 (Nov.) 1930.

In one of Iljaschenko's patients, a man, aged 42, an abscess developed in the inferior pulmonary lobe on the right side. During the six months of treatment, the patient had been given eleven intratracheal injections of Besredka's antivirus, each dose containing from 30 to 60 cc.; fifty-seven intratracheal injections of from 10 to 20 cc. of a 6 per cent oily solution of guaiacol and eucalyptol, and thirty-two intratracheal injections of from 20 to 25 cc. of a 5 per cent water solution of thiocol (once 50 cc. was injected). In addition, five intravenous injections of a 25 per cent solution of dextrose were given; each of three of the injections contained 10 cc. and each of two injections contained 20 cc. The fever almost disappeared, and the daily amount of mucus decreased from 450 to 60 cc.; the cough became notably reduced, and the general condition improved. Another patient, aged 50, presented an abscess involving the middle and the inferior lobes of the left lung. The treatment was continued for about six weeks; it consisted of fifteen intratracheal injections of from 10 to 20 cc. of guaiacol and eucalyptol and one injection of thiocol. This treatment was followed by the disappearance of the odor from the mouth; the temperature became almost normal, and the mucus raised was reduced from 300 to 100 cc. a day. There was relief from the cough, and general improvement resulted. The third patient, a youth, aged 19, suffered with pulmonary tuberculosis and an abscess in the right lung. During the first three months of treatment, he was given five intratracheal injections of from 15 to 25 cc. of antivirus, ten injections of from 5 to 20 cc. of guaiacol and eucalyptol, nineteen injections of from 20 to 30 cc. (once 60 cc.) of thiocol and seven intravenous injections of 20 cc. of dextrose. The treatment was continued for the next five months with two intervals, each of a month's duration. During the second series of treatment, forty-three intratracheal injections of from 10 to 25 cc. of guaiacol and eucalyptol were given. The fever subsided, the cough was considerably diminished; the mucous discharge was reduced, and the subjective signs improved. In a fourth patient, aged 51, the abscess was situated in the inferior lobe of the left lung. Three intratracheal injections of from 15 to 20 cc. of antivirus, thirty-one injections of from 10 to 50 cc. of guaiacol and eucalyptol and two intravenous injections of 10 cc. of dextrose, were given within the first seventy days of treatment. Twenty-four intratracheal injections of from 25 to 50 cc. of thiocol, as well as fifteen injections of from 20 to 50 cc. of guaiacol and eucalyptol, were given within the next seventy days. The cough almost disappeared; the amount of sputum became insignificant, and the fetid odor disappeared from the mouth. The patient gained 21 pounds (9.5 Kg.) in weight. In all cases the clinical improvement was confirmed on roentgenologic examination, indicating that a fibrous tissue had developed in the region previously occupied by the abscess. The intratracheal injections were well tolerated. The author stresses the fact that no decisive conclusions can be drawn as long as the treatment has not been tried in a large number of patients.

EDITOR'S ABSTRACT

DIATHERMY AND HIGH FREQUENCY CURRENTS IN OTORHINOLARYNGOLOGY. K. FUCHS, Monatschr. f. Ohrenh. **64**:1401 (Dec.) 1930.

Fuch's technic for treatment with diathermy is as follows: An electrode provided with two olivary lengthening pieces is introduced in one or in both nasal cavities. Of the two inactive electrodes each 100 sq. cm. large, one is applied to the forehead and the other to the nape of the neck; thus the current reaches the ethmoid labyrinth and the sphenoid sinus. In cases in which the disease is located in the antrum of Highmore or in the frontal sinus, the first electrode is applied to the forehead and the two others, each 50 sq. cm., to the skin above the antrum of Highmore. The strength of the current is from 0.3 to 0.5 ampere, and the duration of the treatment is twenty minutes. Diathermy was used in twenty cases observed for over a year. In eight patients with rhinitis of from one day to sixteen weeks' standing, the pathologic phenomena disappeared after from one to five treatments. Four patients with headache in the frontal region with a duration of from eight weeks to fourteen years were considerably relieved after from six to twenty treatments; a previous submucous resection of the septum performed on two of them had been unsuccessful. A patient suffered for a year with suppuration from the antrum of Highmore, the ethmoid labyrinth on the right side and both sphenoid sinuses, although the antrum of Highmore was punctured regularly and the sphenoid sinus irrigated. After two treatments with diathermy, the intolerable pain in the forehead and in the eyes subsided. A patient with a postencephalitic anosmia of a year's duration improved markedly after four treatments. A patient suffering with pain in the forehead at the point of the mastoid process and at the anterior margin of the sternocleidomastoid was cured after twenty treatments. In one case an excessive redness and itching of the nose persisted for three years and in another for five years. The itching disappeared after three and four treatments, and the redness improved notably after ten and five treatments, respectively. Two patients with a sensation of tension in the tonsillar niches after tonsillectomy were treated with high frequency currents. In one case of three weeks' standing, the improvement was marked after five treatments each of ten minutes' duration; the cure was complete after fifteen treatments. In the other case of six years' standing, an irradiated scar was found displacing the two left palatine arches to the lingual base. Two treatments with the high frequency current brought about a notable improvement. In one case, a severe pain developed in the scar following a plastic operation on the ear; four similar treatments resulted in marked relief.

EDITOR'S ABSTRACT.

PFEIFFER'S GLANDULAR FEVER. R. TERBRÜGGEN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **28**:108 (March 3) 1931.

Terbrüggen first reviews the history of Pfeiffer's glandular fever, which is of interest especially because some authorities doubted that it was a disease *sui generis*. However, all those who had observed a large number of cases agreed that it was a disease entity. The author further describes the clinical course of the disease and then cites some case reports. He states that the etiology is not entirely clear, but he assumes that a streptococcus is probably the pathogenic agent and that the portal of entry is the lymphatic ring. He then mentions the differential diagnostic symptoms by which Pfeiffer's glandular fever can be distinguished from the beginning stage of scarlet fever and from tonsillar septic diseases. The prognosis is favorable. In the treatment, injections of a vaccine preparation and the application of Priessnitz compresses prove helpful. Intramuscular injections of defibrinized parent's blood were also effective in severe cases. Of greatest significance is the treatment and after-treatment of the nasopharynx. In conclusion, the author points out that the disease is highly infectious, and that although it was comparatively rare for a time, recently it has been more frequent, so that Scheer, who also studied Pfeiffer's glandular fever, speaks of an epidemic wave.

EDITOR'S ABSTRACT.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Regular Meeting, Dec. 1, 1930

DR. GEORGE J. DENNIS, *President, in the Chair*

SYMPOSIUM ON SPHENOIDAL SINUSITIS AS A CAUSE OF OPTIC NEURITIS

ANATOMY: THE RELATION OF THE ORBIT AND ITS CONTENTS TO THE PARANASAL SINUSES (LANTERN SLIDES). DR. B. J. ANSON.

The cancellous diploic tissue within four of the seven bones of the orbital cavity is typically replaced by epithelium-lined pneumatic spaces which retain their continuity with the nasal mucous membrane through minute apertures. Any or all of these accessory nasal chambers may extend beyond the customary limits virtually to surround, as a group, the entire orbit. In such instances the capacious maxillary sinus may extend beyond its typical position beneath the orbital floor, and encroach on the medial and lateral walls; the frontal sinus may invade the roof to an unusual degree and, matched in its invasion by the ethmoid cells, may extend backward to the apex of the orbit; here an enlargement of the sphenoid sinus may increase the latter's relation to the cranial and canalicular portions of the optic nerve.

The integrity of the orbit and its contents is constantly menaced by the proximity of these spaces, which, as they lie adjacent to the orbit, may behave as the intermediaries by which a nasal infection becomes orbital.

An infection of this kind, after successfully eroding the thin retaining wall of bone, next encounters the periosteal sheath which is loosely attached to the walls of the orbit. Within this funnel-shaped sheath and embedded in fatty areolar tissue are such important accessory organs of the eye as the ocular muscles, their nerves, the ophthalmic vessels and the optic nerve. The latter is additionally protected by coverings of meningeal origin, which, as they extend forward, become continuous with the protective coats of the eyeball.

NEUROLOGY: THE RELATION BETWEEN THE INVOLVEMENT OF THE SPHENOID SINUSES AND OPTIC NEURITIS. DR. GEORGE W. HALL.

For several years I have been concerned about the relation between multiple sclerosis and retrobulbar neuritis. I shall confine my remarks chiefly to that form of neuritis. It is my opinion that the early cases of retrobulbar neuritis are seen by the ophthalmologist rather than by the rhinologist or neurologist. The ophthalmologist finds on examination that the patients have a central scotoma with an enlarged blind spot, etc., and in many instances he does not give sufficient consideration to the relation between those symptoms and multiple sclerosis. In the majority of such cases, observations during the past few years have taught me to diagnosis multiple sclerosis when central scotomas, loss of abdominal reflexes and a Babinski sign on one side or the other are present. Unfortunately, the neurologist does not come in contact with the majority of these cases during the early period. Most textbooks describe the classic symptoms of multiple sclerosis, such as bitemporal atrophy, nystagmus, scanning speech, intention tremor, disturbances of the bladder, etc., whereas it is well known at present that these symptoms represent a rather advanced case of multiple sclerosis. I

have no doubt that multiple sclerosis is of bacterial origin, the infection no doubt coming through the blood stream. It may originate from foci in different parts of the body.

In determining the causal relation of infection of the sphenoid sinuses to retrobulbar neuritis, one must take into consideration the experience of those who have had a large amount of clinical material in order to compute the relation between the source of infection and the disease itself. I know of no better authority than von Hippel who has for many years protested against the assumption that retrobulbar neuritis is frequently caused by disease of the sinuses. He reported seventy cases seen during the past fourteen years, with forty-eight cures and only one nasal operation. In nineteen of these cases the etiology was multiple sclerosis; in twenty-seven, the etiology was unexplained. He stated that if operation had been performed in the early stages these statistics would have been regarded as highly favorable to operative measures. He further stated that forty-one of the cases in which the etiology was never clear were under observation for several years and that many of them corresponded in their course to multiple sclerosis. Wilfred Harris stated that retrobulbar neuritis is frequently caused by a patch of disseminated sclerosis invading the nerve trunk and producing more or less sudden blindness which may be mistaken for hysterical amblyopia. He further stated that retrobulbar neuritis may also be due to a variety of toxic causes, of which tobacco amblyopia is well known. Central scotoma was described by this author as following the optic atrophy of tabes dorsalis, which sometimes leads to blindness and which occurs rather seldom in cases of disseminated sclerosis. In tabes dorsalis the lesion is a parenchymatous degeneration of the nerve fibers, while in disseminated sclerosis the lesion is primarily inflammatory.

Friedenwald stated that the optic nerve in its path through the optic foramen is brought close to the sphenoid sinus. It has been shown that considerable variation exists in the structures of this region. It has also been claimed that certain cases of retrobulbar neuritis are greatly helped by the treatment for concomitant disease of the nasal sinuses, usually involving the sphenoid or ethmoid sinuses. He expressed the opinion, however, that a causal relationship between these two diseases has never been proven. He further stated that a large proportion of the cases of retrobulbar neuritis are due to multiple sclerosis, the typical lesion of which has been demonstrated in the optic nerve. He also mentioned the fact that this involvement may be of syphilitic origin. In the discussion of a paper by Robert J. Hunter, Vail stated that he had never seen a case of retrobulbar neuritis of nasal origin in a child. George E. Brown, in reporting sixty cases, stated that the primary focus occurred in the tonsils in 17 per cent, in the teeth in 14 per cent and in the antrum in 2 per cent, and that in only six cases was the ethmoid sinus involved.

Leon White stated that the absence of visible disease in the sinuses in cases of retrobulbar neuritis caused him to look for other foci of infection. He was of the opinion that invasion is through the blood stream and that the accessory sinuses play only an insignificant part as the primary focus of infection. He further stated that in his opinion most of the foci are in the teeth and tonsils, and that among the sinuses the antrum is the most frequent seat of infection. In 80 per cent of his series of cases the patients had infected teeth or tonsils, whereas sinusitis was present in only a small percentage of the cases. On the other hand, one can find many authorities who are just as firmly convinced that infection of the sinuses is the cause of retrobulbar neuritis in the majority of cases. For instance, Glasscheib stated that there is a definite connection between disease of the sinuses and retrobulbar neuritis, and he expressed the opinion that operators frequently overlook the presence of disease of the sinuses at the time of operation. He stated that a transudate of the ethmoid and sphenoid cavity may be present, with the formation of edema. He quoted Weill as being opposed to such a theory. The latter authority concluded that rhinologists do not find retrobulbar neuritis in association with postsinusitis and that ophthalmologists do not find disease of the sinuses in acute retrobulbar neuritis.

Langenbeck reported 176 cases of retrobulbar neuritis in which he found only 3.5 per cent of nasal origin; 77 of the patients had multiple sclerosis. Consequently, one cannot minimize the value of reports such as those mentioned. Considering the statistics at their face value, it appears to me that one must arrive at the conclusion that disease of the sinuses is a rather infrequent etiologic factor in the production of retrobulbar neuritis; that retrobulbar neuritis probably is secondary to foci of infection located in almost any part of the body, leading to rather diffuse changes in the central nervous system which actually correspond to those of multiple sclerosis, and that multiple sclerosis is encountered probably as frequently as all other causes combined.

I desire to make it plain, however, that I have no quarrel with either the rhinologists or the ophthalmologists, that I can only hope that these specialists may become more interested in this subject, and that there may be more frequent consultation with them than in the past in order that greater service can be rendered the patient. I believe that if the early diffuse changes in the central nervous system can be diagnosed when the ophthalmologist first sees these cases of central scotoma, or shortly afterward, treatment may be instituted whereby the progress of the disease can be checked and the patients do not become complete invalids.

OCULAR SYMPTOMS. DR. GEORGE F. SUKER.

There are two clinical types of involvement of the optic nerve: optic neuritis and retrobulbar optic neuritis. In the former, the papillomacular fibers are seldom if ever implicated, but in the latter the involvement of this bundle is the characteristic feature. Either type may be due to toxins or constitutional lesions. In optic neuritis the objective clinical indications are usually limited to the optic disk at the outset, and subsequently descend into the nerve. While in retrobulbar optic neuritis few changes, in fact only two, are seen at first (in a triangular temporal area of the disk), subsequently the whole disk may become involved.

Except for a few cases, the prognosis is decidedly more favorable in retrobulbar neuritis than in optic neuritis.

Aside from tumors, congenital anomalies of the sphenoid, associated with disease, and injuries of the sphenoid sinus causing optic neuritis, choked disk and changes in the fields, sphenoidal sinusitis seldom causes retrobulbar optic neuritis.

No doubt, retrobulbar neuritis can be caused by diseases of the sphenoid, but this is so rarely the case that conclusive evidence is not found, either clinically or pathologically. One must be extremely careful, therefore, in dogmatically stating that a large percentage of cases of retrobulbar neuritis are of sphenoidal origin. No doubt, it is possible for retrobulbar neuritis to develop, particularly if so-called pathologic anatomic variations of the sphenoid exist which permit of the implication of the retrobulbar nerve and if there is a septic condition in the sphenoid sinus.

In by far the largest percentage of cases, retrobulbar neuritis is self-limited and the nerve recovers without operation on the sphenoid sinuses. When direct toxicity, such as that caused by alcohol and other poisons, injuries and hereditary diseases, including syphilis, cannot be elicited, retrobulbar neuritis is usually the precursor of multiple sclerosis.

Frequently no active disease can be found in the sphenoid sinus when retrobulbar optic neuritis is present, and the removal of redundant sphenoid tissue followed by a disappearance of the neuritis does not indicate a causal relationship.

Enlargement of the blind spot is not retrobulbar optic neuritis, even in the presence of a sphenoidal complication. The enlargement is not necessarily associated with central scotoma, neuritis or visual reduction. Pressure on the retrobulbar nerve from any cause can produce an enlarged blind spot, but if the enlargement is associated with central scotoma, visual reduction, interference with the field and temporal pallor of the optic disk there is true retrobulbar optic neuritis. One seldom makes these observations when suspicion is directed to the sphenoid sinus. Before it can be definitely stated that the sphenoiditis is the

etiologic factor of retrobulbar optic neuritis, it is obligatory to eliminate the following more potent and usual causes: (1) acute myelitis, (2) multiple sclerosis, (3) Leber's hereditary optic atrophy, (4) tobacco-alcohol amblyopia, (5) diabetic amblyopia, (6) neuritis from a gravid uterus, (7) lactation, (8) sinus infection, (9) infections and intoxications, (10) cerebrospinal syphilis, (11) tuberculosis, (12) typhus, (13) erysipelas, (14) beri-beri, (15) influenza, (16) mumps, (17) pneumonia, (18) angina, (19) meningitis, (20) encephalitis, (21) smallpox, (22) measles, (23) pertussis, (24) vaccination, (25) Bright's disease, (26) severe burns of the hands and face, (27) carcinomatosis, (28) tumors of the frontal lobe, (29) lesion of the posterior angle of the chiasm, (30) methyl alcohol, (31) quinine, (32) tabes, (33) lesions in the vicinity of the posterior angle of the chism, (34) lesions of the third ventricle, (35) abscess of the brain and (36) hyperthyroidism. These by no means complete the category.

So frequently do remissions occur in retrobulbar optic neuritis due to the conditions mentioned, that should a sphenoid be diseased and apparent improvement follow operation on it, sphenoiditis cannot be called the true etiologic factor. Retrobulbar optic neuritis often precedes some of these systemic dyscrasias by months or years.

The papillomacular fibers of the optic nerve are susceptible to toxins, especially the retrobulbar section of this bundle, because they are more exposed near the chiasm than anywhere else in the nerve or tract. It is not uncommon for basal lesions or toxins to produce enlargement of the blind spots, central scotomas and consequent disturbances in the fields and vision with or without evident temporal pallor of the disk, thus giving rise to a picture of retrobulbar optic neuritis.

It is true that when dehiscences and active infection of the sphenoid are present a retrobulbar neuritis can ensue. This is an anatomic abnormality, however, allowing the passage of the toxins into the vicinity of the retrobulbar nerve. These dehiscences are not as frequent as supposed retrobulbar optic neuritis of sphenoidal origin.

Though the anatomic relation between the sphenoid wall and the retrobulbar nerve may be intimate, the dense periosteum lining the sphenoid sinus and the sheath of the nerve will scarcely permit of easy or ready access of sphenoidal infection to the papillomacular fibers. Investigators in this field have rarely reported cases of retrobulbar optic neuritis in which a portion of the retrobulbar nerve was completely enveloped within the sinus and in which so-called sinusitis existed.

Optic neuritis may follow infection of the sinuses. In such instances there are inflammatory manifestations on and in the disk unassociated with a central scotoma for color and temporal pallor. However, optic neuritis and retrobulbar optic neuritis are not one and the same lesion. The latter seldom shows any changes in the disk other than a temporal pallor, except in the latter stages; then neuritis may have developed, and an operation on the sphenoid sinuses may be of no benefit. There are so many other potent underlying lesions than sphenoidal disease causing retrobulbar neuritis that the latter can only be exceptional and incidental.

The classic triangular temporal pallor of the disk in retrobulbar optic neuritis I have not seen in any case due to so-called sphenoiditis.

The diagnostic clinical features of retrobulbar optic neuritis are: (1) triangular pallor of the temporal quadrant of the disk, an area in which the capillaries are practically invisible or markedly attenuated; (2) a central scotoma for red and green, and at times for other colors; (3) pain when the globe is pressed into the orbit; (4) more or less pain in ocular movements; (5) in rare instances, enlargement of the blind spot; (6) possible infringement on the visual field; (7) early reduction in visual acuity; (8) no disturbance in the contour of the disk, except when neuritis of the disk supervenes; (9) no changes in the vessels of the disk except in the area of temporal pallor, unless there is an engrafted neuritis of the disk; (10) in rare cases, obliteration of the physiologic cup of the disk; (11) no

minute hemorrhages or exudates in the adjacent area, and (12) the appearance of choked disk usually absent.

In optic neuritis the diagnostic points are: (1) The contour of the disk is apt to merge with the adjacent retina; (2) the physiologic cup is often obliterated; (3) the contour of the vessels is disturbed; (4) there is no triangular pallor of the temporal quadrant; (5) the whole disk is distinctly inflamed; (6) minute hemorrhages on or adjacent to the disk may occur; (7) it is not unusual to observe some exudate on disk or in its immediately vicinity; (8) visual acuity is frequently reduced; (9) infringement on the fields is rather common; (10) pain is rarely present, either on rotation or when pressure is applied to the globe; (11) the disk is not uncommonly so swollen as to be mistaken for a choked disk, and (12) the blind spot is usually enlarged.

In my experience, retrobulbar optic neuritis resulting from a sphenoidal lesion is extremely rare. However, so-called optic neuritis, with the characteristic enlargement of the blind spot is not uncommon. In all diseases of the sinuses one should examine the blind spot carefully, as it often shows an early manifestation of impending toxic optic neuritis.

A New Method of Demonstrating the Relation Between the Sphenoid Sinus and the Optic Nerve. Dr. Harris H. Vail.

This article will appear in full in a later issue of the Archives.

DISCUSSION

Dr. Harry Gradle: I feel that there are other phases of the subject than a blanket denial that such a thing as rhinogenic retrobulbar neuritis doses not exist. I am certain that it does. Disease of the nasal sinuses is perhaps not as frequent a cause of retrobulbar neuritis as some believe, but it is not as infrequent as others believe.

Optic neuritus *per se* is not evidence of disease of the sinuses. Toxemia due to disease of the sinuses seldom produces involvement of the optic nerve. The involvement is of the retrobulbar type. If one considers the orbit and the canal through which the optic nerve passes, a few important structures are noted. As the posterior mesial wall of the orbit is formed in part by the lateral wall of the sphenoid or ethmoid sinus, the separation between these cavities and the orbit is a thin plate of bone. Lining the wall of the orbit is the periosteum, which fuses at the optic canal with the dura covering the optic nerve, so that any toxin passing through the plate of the orbit and involving the periosteum will involve the dura in this rigid canal. When one considers the structures that lie between this point and the orbit, one notes first the vascular portion of the optic nerve, then the avascular portion and then the intracanalicular portion. If the offending agent involves any portion of the nerve posterior to the entrance of the central artery of the retina, the involvement is manifested only by a study of the visual fields of that patient. The avascular portion between the entrance of the central artery and the intracanalicular portion is not likely to be involved. In cross-sections of the nerve in the intracanalicular part, the fibers that come from the retina immediately around the optic nerve are found in the periphery. In the central portion there is a horseshoe-shaped bundle containing the fibers relating to the central vision. The remainder of this portion is filled with nerves coming from the periphery. The first portion to suffer consists of the fibers that come from the blind spot, and the first indication of a retrobulbar neuritis is not central scotoma or pallor of the disk, but enlargement of the blind spot, which can be measured accurately. When the process has advanced far enough to produce a central scotoma, it has then involved the nerve in the central portion and a much more serious condition is present. There are undoubtedly many cases of retrobulbar neuritis of rhinogenic origin that are due to a blockage of the aperture with reversal of the drainage. Many of those cases are doubtless over-

looked entirely. Many of the cases are overlooked until the process has progressed to the formation of central scotoma. However, by careful search of the blind spot in many cases of retrobulbar neuritis presenting to a mild degree the symptoms that Dr. Suker mentioned, one can observe enlargement of the blind spot which will progress gradually to scotoma for colors, and then to complete central scotoma.

It is equally true, as Dr. Hall said, that many of the cases due to multiple sclerosis will improve on ventilation of the sinus. It is also true that many of the cases that have been attributed to disease of the sinuses will finally prove to be cases of multiple sclerosis. I have been looking for those cases since 1914 and have a fairly good record of them. If those patients were going to have multiple sclerosis it would have developed before this time.

Another point is that the retrobulbar neuritis that is manifested primarily by central scotoma is due to lesions lying in the central area of the optic nerve. Lesions lying in this central area may well produce central scotoma and temporal pallor of the disk as a primary lesion.

I wish to go on record as stating my belief in a definite retrobulbar neuritis of rhinogenic origin, which can be relieved if proper treatment is instituted.

Dr. Edwin McGinnis: Of the lessons that can be learned from this meeting, that of cooperation is paramount. This subject is of great interest and I think that there is something to the theory that infection of the nasal sinuses is a cause of retrobulbar neuritis. Dr. Hall emphasized the neurologic side of the question. I think that if a thorough investigation is made, with careful check-up, one will find that many patients have nervous upsets and that many have infection of the sinuses as well. It is hard to prove experimentally that one can take organisms out of the nose and produce optic neuritis in an animal, but if this was possible, it would help in determining the etiology. The best thing is to arrive at a diagnosis, make neurologic and ophthalmologic observations and consider all these together. In a patient who has become blind and who has been examined by a competent ophthalmologist and neurologist, if operation on the nasal cells improves vision and tension in twenty-four hours the infected cell is probably responsible for the ocular condition. If vision becomes dim a few months later, following a cold, and improves under treatment of the nose, one can again consider that the infected cell probably had something to do with the condition. I have had several cases of this kind.

I do not wish to believe that in every patient with retrobulbar neuritis examination of the sphenoid cells will immediately disclose an infection. I think that one should, however, examine the nose for an infection. Often an infection will be found in the anterior cell group.

I shall now consider multiple sclerosis. A patient had a nasal discharge which was more evident on the left side. She was referred to me by Dr. Wilder with a diagnosis of retrobulbar neuritis. My diagnosis was ethmoiditis, and I opened both ethmoid cells back to the sphenoid. No improvement occurred in the eye for from six to eight weeks. After the patient went home vision returned, but multiple sclerosis developed. She was in bed for some time, but the multiple sclerosis cleared up. She then had a vision of 20/20 and was grateful for what I had done.

I was glad to see Dr. Gradle's drawings and hear his remarks on the possibility of infection in the optic nerve just back of the eyeball. I have seen patients with optic neuritis and no invasion of the posterior cells. I have operated on the ethmoid sinus in about 1,200 cases in the last sixteen or eighteen years and I use a procedure by which I can watch each cell as I open it. It is surprising how few of the cells look as though they had bacteria in the membrane.

Dr. Robert Blue: I was recently consulted by a young lady who gave the following interesting history. Two weeks before I saw her she underwent a laparotomy. While she was in the hospital a disturbance of vision developed which she did not recognize. On her return home, however, the visual defect

attracted her attention in the following manner: She had a lamp with a red globe. When she closed her right eye she could not see the red globe when looking directly at it; on looking either above or below it, however, she could see it. She stated that she had a similar attack in the other eye about nine years before. At that time she had been in Cincinnati and had consulted Dr. Derrick Vail, who made a diagnosis of retrobulbar neuritis and referred her to Dr. Harris H. Vail. Dr. Vail opened the sphenoid and posterior ethmoid cells, and a week later vision returned to normal; that is, she was able to count fingers at 2½ feet (76 cm.); there was definite central scotoma. The only other symptom was a sensation of pressure on rotation of the eye. The left eye was a trifle more sensitive than the right, but there was no actual pain, just slight discomfort. I asked her if she could see well with that eye before, and she told me that it had always had poor vision and that it had been crossed when she was a child. I made a diagnosis of probable retrobulbar neuritis in an amblyopic eye. At the request of her surgeon I referred her to Dr. Bookwalter, who made a roentgenogram and found the ethmoid sinuses clear. I saw her again in less than a week and found that vision had improved in the affected eye to the extent that she could count fingers at about 20 feet (610 cm.). On the same day I received a letter from Dr. Vail in which he gave the data obtained nine years before. At that time, vision in the right eye was an ability to count fingers at a few feet; about twelve days later, vision was 20/30. The vision noted at my last examination of the left eye was ability to count fingers at about 20 feet, which approaches the vision of 20/200 which she had nine years before.

This patient gave one rather interesting fact in the history. Some years before, she had noticed visual disturbances after taking general ether anesthesia. These did not concern her sufficiently, however, to call the attention of her physician to them. She thought that the attack was similar to the present one. I am inclined to give a little more than average weight to her history, because it was borne out accurately by the report that I received from Dr. Vail. We have not established the etiology in the present attack, but infection of the sinuses is apparently ruled out. The ether anesthesia is a possible cause, although I have never observed a case of retrobulbar neuritis due to ether. I presume that the patient will have to be referred to Dr. Hall to discover whether or not the underlying cause is a multiple sclerosis.

Dr. John A. Cavanaugh: The relation of sphenoidal infection to retrobulbar neuritis has been of great interest to me, and I have been studying its various phases for a long time. About eight years ago, I conferred with Dr. Hubeny on the possibility of detecting the relation of the optic nerve to the sphenoid sinus, according to the principle of locating a foreign body in the eye. He did not think that this could be done since there were no fixed anatomic relations such as are used for detecting foreign bodies in the eye. However, we made a number of roentgenograms which showed the sphenoid sinus overlapping the optic foramen. The relation varied in the different subjects, which we attributed to the development of the sinus.

The fluids used were varied: bismuth in buttermilk or malted milk, iodized poppy seed oil 40 per cent and bromipin. I do not agree with Dr. Vail's remarks on bromipin. There are two types of the drug, light and heavy, and the type is selected according to the picture described.

There is much to learn regarding the sphenoid sinus. Certain cases show localized areas of involvement that are hard to diagnose, and it is difficult to get postmortem material.

Dr. Walter H. Theobald: After hearing the first part of this symposium I thought that retrobulbar neuritis originating in the accessory sinuses had taken a tailspin, but the work that Dr. Vail has presented is well worth while. He has provided something definite on which to base the diagnosis. He stated that an injection is made into the sinuses and that if the opening is not exposed and accessible he makes an opening into the sphenoid. He did not say anything about

normal drainage of the sinus. Dr. Gradle pointed out that a blocked sinus would cause pressure or retention. Dr. Vail is therefore basing his information on thickened membranes only, and not on retention of secretions or their delayed drainage.

Illustrating this point, I will briefly review a case that I saw with Dr. Gradle in which we used the method so well brought out by Dr. Proetz, namely, the introduction of radiopaque substances into the posterior sinuses by negative pressure. A woman, aged 30, was rapidly becoming blind in one eye. She had retrobulbar neuritis. Roentgenograms were made by injecting iodized poppy seed oil with negative pressure. On the affected side the sphenoid sinus did not take up any of the oil, and we therefore concluded that it was blocked. Whether there was a thickened mucous membrane or not was not of importance; the sinus was completely blocked. She was operated on and the result, as in many of the cases cited, was that vision returned to ability to count fingers on the third day and to read a newspaper inside of a week.

DR. HARRIS H. VAIL: Replying to Dr. Cavanaugh's question, the bromipin used in the one case mentioned was that which a salesman left in my office for trial. I do not know whether it was the light or the heavy preparation.

The point brought out by Dr. Theobald is a good one. Dr. Proetz' suction displacement method is an excellent means of filling the posterior sinuses, but if I remember correctly, his interpretations are based on the emptying time of the sphenoid sinus. When one studies the sphenoid sinus in suspected retrobulbar optic neuritis, one is usually dealing with an acute infection that often has subsided by the time the patient is first observed. I therefore believe that in these cases it is much more important to study the sphenoid sinus for filling defects than to study it from the standpoint of its emptying time.

Herzog, as I mentioned, found cases of acute sinusitis in which microscopic examination revealed no evidence of infection in the mucous membrane and yet there were definite signs of inflammation in the submucosa and marrow spaces. One would hardly expect, therefore, to find many instances of filling defects in the sphenoid sinus in cases of retrobulbar optic neuritis. However, one case of recurrent attacks of retrobulbar optic neuritis showed a slight thickening of the sphenoid sinus mucosa.

It is important to remember that the roentgenograms should be made with the patient's head in the vertical position both for anterior, posterior and lateral views. Since I have used the special angle to show the filling of the upper outer portion of the sphenoid, I believe that I can determine just how close the radiopaque substance comes to the optic canal.

When I am unable to get into the sphenoid sinus through the ostium I puncture the front wall. It takes a good deal of time to carry out this method as there must be thorough cocainization, just as for an operation on the sphenoid sinus. In some cases, on account of septal deviation or very large middle turbinates, it is impossible to make an injection into the sphenoid sinus, but in every suspected and true case of retrobulbar optic neuritis that I have seen, it has been possible to make the injection either through the ostium or by puncturing the anterior wall.

I enjoyed Dr. Hall's paper very much. The question of multiple sclerosis is, of course, extremely important and interesting, and one must bear in mind the fact that the agent causing multiple sclerosis may get into the central nervous system by way of the posterior nasal sinuses. Whether any experimental work along these lines can be done with animals I do not know. I think that it would be rather difficult on account of the anatomic development of the sinuses in animals, particularly in dogs.

In chronic nasal sinusitis a barrier must be formed around the focus of infection in the sinus, but like barriers elsewhere in the body, it may show gaps. I believe that retrobulbar optic neuritis occurs more frequently in acute infections of the sinuses because, on account of the anatomic relationships, infection can involve the nerve before the defenses of the patient can develop.

MASSACHUSETTS EYE AND EAR INFIRMARY, OTO-RHINO-LARYNGOLOGICAL SERVICES

EDITED BY PHILIP E. MELTZER, M.D.

Clinical Meeting, Dec. 24, 1930

CELLULITIS OF THE FACE. DR. H. G. TOBEY.

In the case reported the right antrum was washed out in the outpatient department, with resulting cellulitis of the face. Considerable swelling of the cheek remained. The last roentgen report showed a small area of osteomyelitis of the anterior wall. There was much less reaction over the cheek, and it seemed to be centered at one spot. Doubt was expressed as to the proper procedure: whether to perform a radical operation on the antrum, removing the antral mucous membrane, to make an external incision and treat the osteomyelitis or to wait still longer until the condition became localized.

DISCUSSION

DR. F. E. GARLAND: The question is whether there is definite necrosis of the bone. How long has the process been going on?

DR. HERMAN: It is a month since the original process started.

DR. TOBEY: The plates shown were the last ones taken. Dr. MacMillan reported osteomyelitis of the anterior wall on the right side.

DR. GARLAND: Has the patient fever at the present time?

DR. TOBEY: The patient does not have fever.

DR. GARLAND: I should enter the canine fossa and clean out the antrum.

DR. H. P. MOSHER: I should do the same.

DR. TOBEY: That is the opinion expressed on this service: to enter the canine fossa and clean out the antrum and some of the bone.

DR. H. CAHILL: I had two cases, one of which was also observed by Dr. MacMillan, that were followed for about two years. Roentgenograms taken from time to time showed sequestrums which I removed as they formed. The patient was well when last seen. The other case was one of bilateral osteomyelitis in which Dr. Kirby and I removed sequestrums occasionally. I last saw the case two weeks before the present meeting. I let out localized collections of pus by simple incision and drainage. There is no need for a radical operation. I should take out only the loose bone as it sequesters.

DR. L. RICHARDS: At the Children's Hospital the children are so young that one cannot perform a radical operation. I have seen the osteomyelitis reach as high as the zygoma. I have even seen part of the hard palate come away.

ABSCESS OF THE NECK. DR. H. G. TOBEY.

A man had been shown at the meeting two weeks before because of keratosis of the larynx. A few days after the meeting, a specimen was removed under direct laryngoscopy. Three days later, there began to be redness, tenderness and swelling over the thyroid process. This spread and became considerably more thickened, and fluctuation appeared. An incision, one-fourth inch (6 cm.) deep, was made into the pork-like tissue and about 2 ounces (59 Gm.) of foul-smelling greenish pus was evacuated. The opening was large enough to admit a finger. Nothing could be felt. The cartilage could not be identified. With the swelling there was considerable difficulty in breathing and swallowing, with considerable edema about the arytenoid cartilage. That subsided later.

DISCUSSION

DR. A. MCLEOD: The microscopic observations were: no malignancy, hyperplasia and a papilloma with marked keratosis.

DR. TOBEY: The patient is swallowing normally now. There is no edema, but some infiltration of the left arytenoid cartilage is still present.

DR. T. E. HERMAN: I have not made a diagnosis yet. This curious white area showing the papillomatous mass covered with white keratosis was reported as papilloma without any evidence of malignancy. I do not understand why this foul abscess should appear immediately after the removal of a piece for biopsy. The whole picture is something that I do not recall in my experience.

DR. GARLAND: I should be inclined to insert a tracheotomy tube to rest the larynx, with the hope of stopping the spread of the disease.

A PLASTIC OPERATION ON THE FACE. DR. V. H. KAZANJIAN.

A woman had had complete paralysis of the right side of the face for many years. The appearance was that of extreme onesidedness. Two operations were performed. At the first, a small incision was made at the lower border of the mandible; the masseter muscle was exposed and two thirds of it split from its base. After tunneling the face, the muscle was connected with the orbicularis oris by sutures. That helped a good deal, but there still was facial distortion. Two weeks before the present meeting strips of fascia lata were taken, one end being connected to the orbicularis oris. The tissue of the face was then tunneled and the other end of the fascia lata sutured to the temporal muscle. Two bands were used: one from the upper lip upward and one from the lower lip to the same region. When the patient is not using the facial muscles, the outline of the lip is fairly good. When she talks and smiles, the normal side moves disproportionately. The masseter muscle is functioning; when the patient bites, the corner of the mouth moves in tension.

DR. MOSHER: Has the piece of muscle a nerve supply?

DR. KAZANJIAN: Yes. In all probability, I have not injured the nerve endings. When the patient bites, one can feel the tension of the muscle on the side. I expect the facial strip to form a tough fibrous band and so help the tension of the muscles on that side.

PLUMMER-VINCENT'S SYNDROME. DR. G. E. SHAMBAUGH, JR.

A patient who was in the Eye and Ear Infirmary three weeks before the present meeting was transferred to the General Hospital with a secondary anemia. There the diagnosis of Plummer-Vincent's syndrome of the mouth and throat was made. This condition is supposed to be associated with a web of the esophagus and secondary anemia. The patient usually has a sore throat with pernicious anemia, and then the web and adhesions are found. In this case the adhesions were divided, which gave temporary relief. For the last six months dilation had been performed with bougies. She returned to the Infirmary three weeks ago for dilation and was sent to the medical department for studies of the blood, where the diagnosis was made. Since then she had been treated for the anemia and had improved. At the time of the meeting no dilation was necessary.

DR. MOSHER: At the last meeting it was said that this was the first time this type of case has been recognized here. The diagnosis of Plummer-Vincent's syndrome was made at the General Hospital. It seems that this disease is associated with a smooth tongue. That would account for the pathologic process that causes the web, but I cannot see how clearing up the anemia produces dilatation of the web.

MUCOCELE OF THE FRONTAL SINUS. DR. H. A. BARNES.

In a case presenting some unusual points, the patient had had symptoms for fifteen years. During the last year there had been some exophthalmos and occa-

sional diplopia. On the affected side the nose was completely blocked off. The outer wall was pressed over to the septum, and what appeared to be the lower turbinate was very large. There was a question as to whether a malignant growth was present in the antrum which was pushing the naso-antral wall medialward. Roentgenograms, however, showed nothing in the antrum. At operation a saccule of pus was found which involved the frontal sinus and extended into the nose; it appeared like a turbinate pressed toward the septum. The pus was drained out of the frontal sinus which collapsed completely, leaving only the mucous membrane of the outer wall of the nose. It seemed that the mucocele had absorbed the septum high up. The middle partitions of the sphenoid sinus were taken down so that the sphenoid cavity and the ethmoid and both frontal sinuses were one large cavity. The posterior lining of the frontal sinus was not removed. The lining of the mucocele was entirely removed except in the posterior portion of the sinus. The question now is whether it might be desirable to remove all the membrane.

DR. D. C. SMYTH: Two or three weeks before this meeting Dr. Mysel operated on a mucocele and was much criticized for leaving the lining. In four of my cases I left the lining and observed no recurrence. I note in the literature that sometimes the operation is performed only on the ethmoid sinuses, the frontal sinus being left alone. I left the greater part of the lining of the mucocele in and obtained excellent results.

DR. MOSHER: Why not remove the posterior wall of the mucous membrane?

DR. SMYTH: There is a perfectly lined cavity with good drainage in the nose through the region of the exenterated ethmoid cells.

DR. BARNES: When one leaves the whole of the capsule why could the mucocele not recur? In this case practically all of it was removed except posteriorly.

DR. SMYTH: It is no longer a cyst. There is a hole into the nose after it is removed.

DR. MOSHER: A mucocele makes the best opening into the nose that can be made. It will turn everything into a single cavity. Dr. Smyth has therefore much justification for leaving the mucous membrane in. Of course it will regenerate.

DR. TOBEY: In my records I find mention of one very large mucocele removed ten or twelve years before this meeting, with no recurrence. I should like to retract my earlier statement as to recurrence if the lining is left.

DR. MOSHER: I think that Killian devised his operation as the result of removing a mucocele. I was much interested in the examination of the live mucous membrane immediately following this operation. A number of specimens of mucoceles that have been examined by ordinary methods have showed little. However, in the specimens in our files there are few glands; the best specimen is nothing but fibrous tissue. On the other hand, the live specimens showed a satisfactory number of glands to account for the pathologic process in the mucocele; they also revealed an intact epithelium in places and large cilia. In this case the cilia were still alive after fifteen or twenty years. The contrast between live mucous membrane of the sphenoid and of the frontal sinus is striking. One could not put the objective any place without finding live cilia. The significant point in connection with the sphenoid is that there are few glands.

FIBROSARCOMA OF THE PHARYNX. DR. H. A. BARNES.

In June, 1929, a patient was seen who had a hard, smooth, nonulcerated tumor on the right side of the pharynx. Dr. Garland operated on him, carrying a snare around the more or less pedunculated tumor and then removing the growth by diathermy. The base of the tumor was cauterized by diathermy and the patient remained without symptoms for about sixteen months. Then he began to have symptoms of dysphagia and was readmitted to the hospital. He was operated on by Dr. Tobey, who removed another growth with diathermy and snare. The patient

still had a tumor mass at the same point, but it was not as large as that originally described. Ulceration was present, as a result of diathermy. The patient swallowed well. The microscopic examination showed fibrosarcoma in both instances. Uncertainty was expressed as to the next step.

DR. MOSHER: Why not use radium?

DR. BARNES: It seems to me that radium is the only logical thing to use now. The diathermy knife is liable to cause a cicatrix and further trouble. Radium does not produce scarring.

ACTINOMYCOSIS OF THE ESOPHAGUS. DR. F. L. WEILLE.

About four months before this meeting, an esophagoscopic examination was made of a patient supposed to have carcinoma. A bleeding lesion was found, 12 inches (30.4 cm.) from the teeth, on the posterior and left lateral wall of the esophagus; it bled freely and masses projected from its surface. One was quite large and was used for a biopsy. It appeared to be carcinoma, but the history of marked difficulty in swallowing was of only two week's duration. There was a sudden onset, and the patient had been unable to take liquids or solids. She had vomited blood. The specimen was brought to Boston, and Dr. Mallory reported chronic inflammatory tissue strongly suggestive of actinomycosis. There were two or three colonies in the specimen, one suggestive of *Actinomyces*. The patient was given potassium iodide, and fed through a gastrostomy tube. Later she took fluids by mouth without difficulty. She was discharged from the hospital and returned to Brattleboro, Vt. The day before the meeting Dr. Mosher was present at an esophagoscopic examination in which the lesion was again disclosed, 12 inches from the teeth. It was about 1.5 cm. in each direction, about 5 mm. high and covered perfectly with epithelium. With respiration the movements of the esophagus were restricted at the points of the lesion, and above and below, the esophageal wall moved freely.

DR. BARNES: When the mass was first seen, did it suggest actinomycosis?

DR. WEILLE: No. The patient is a farmer's wife. There is no reason why one could not have actinomycosis of the esophagus as well as of the appendix.

ULCER OF THE ESOPHAGUS. DR. D. C. SMYTH.

Three or four days before this meeting a patient with ulcer of the lower end of the esophagus was seen on the medical service of the Massachusetts General Hospital. Dr. Adams had three cases and thought that this fitted in with the others. The patient had symptoms of regurgitation of food, with shooting pains in the middle of the sternum.

DR. MOSHER: I have never seen a case of ulcer of the esophagus to know it. Some physicians see them constantly.

DR. BARNES: Are the ulcers always at the cardiac end or are they higher up?

DR. SMYTH: In my case the ulcer was 4 inches (10 cm.) from the cardiac end.

DR. MOSHER: I saw this case in consultation with Dr. Smyth. The thing that surprised me first was the good condition of the patient. The second was that the pain usually occurred after eating and that it was not the typical radiating type relieved by bicarbonate of soda. I thought that radiating pain occurred in the front and back and that it was relieved by bicarbonate of soda.

NEUROFIBROMA. DR. MCLEOD.

A microscopic section from a patient, aged 28, who had undergone a radical operation on the antrum, ten years before, was shown. For the past year he had been having pain in the right cheek which did not radiate. It was considered a neurofibroma, which it proved to be. These tumors may arise from the specialized nervous tissue or from the supporting connective tissue. The first type is usually

described as a neuroma and the latter as a neurofibroma. The present section showed nervous tissue with an overgrowth of connective tissue, and resembled an amputation neuroma. The section was taken from the infra-orbital nerve.

DR. LURIE: Before the operation I injected alcohol twice. When I opened the antrum the wall was not completely healed and was filled with this fibrous tissue. The infra-orbital nerve ran directly through the tissue. I resected part of the nerve at the first operation. The tumor was not in the antrum. The latter was lined with epithelium.

THROMBOSIS OF THE LATERAL SINUS. DR. P. E. MELTZER.

A woman, aged 25, had had diphtheria many years before the present illness; it was followed by a continuous but slight discharge. She was well from that time until about one month before the present meeting, when she began to have pain in the left ear. Four days before admission to the hospital the discharge suddenly ceased and pain immediately developed in and about the ear, with generalized headache, nausea, vomiting, dizziness and elevation of temperature; several chills occurred. On her admission to the hospital, examination showed a postero-superior perforation of the drum, with a small amount of cholesteatomatous material coming through the perforation; there was tenderness over the tip, with edema in and all along the sternocleido-mastoid muscle to the clavicle. The temperature was 101.5 F. on admission; the white blood count, 18,000. The fundi were normal. Neurologic examination showed nothing more than a double Babinski reflex; this had frequently been noted in cases of this kind showing elevation of temperature but no other meningeal signs. The red blood count was 4,000,000, and the hemoglobin content between 75 and 80 per cent. A roentgenogram showed a cholesteatomatous cavity in the region of the antrum. The rest of the mastoid was completely sclerosed. A physical examination gave negative results. A lumbar puncture was performed and the initial pressure was 360. The Tobey-Ayer test showed complete blocking of the left lateral sinus. At operation the mastoid bone was found to be very dense. The lateral sinus was necrotic, and a pulsating discharge of thin foul pus escaped from its lumen. The sinus was exposed from the knee to the bulb. There was complete thrombosis as far as examination could be made. The jugular vein was ligated low in the neck and was markedly thickened and infected. The facial nerve was tied off and was also found to be thickened. The jugular vein was cut distal to the lower ligature. The upper portion of the vein was turned out through the incision in the neck and sewed to the skin. There was feeble bleeding from the bulbar region, but profuse bleeding at the knee of the lateral sinus. The patient was in shock and was treated for this condition. Lumbar puncture at the time of operation showed a clear fluid with 23 cells. The elevation of temperature continued, remaining around 103 F. The patient complained of severe headache. There had been no vomiting since her admission to the hospital but she had slight nausea. She felt dizzy on movement. It was concluded that she had an old perisinus inflammation with thrombosis which was reinfected by an acute exacerbation of the condition of the middle ear.

DR. D. H. WALKER: The white blood cell count is low for such serious symptoms.

DR. MELTZER: This morning it is 30,000. The eyegrounds are normal.

DR. L. BOIES: The Shilling count has risen to 30. It was 22 on admission.

DR. MOSHER: One rarely sees a markedly infected jugular vein. I suppose that the infection runs along the wall of the vein.

DR. MELTZER: No pus was seen in the lumen of the jugular vein; there was just a mural thrombus all the way down. We did not wash through from the jugular bulb because a little bleeding occurred from the upper end. The rising temperature and headache suggest a secondary meningitis.

DR. WALKER: This is a massive infection which probably extends back toward the torcular herophili. What surprises me is that she has not yet shown evidence of emboli.

DR. FAUNCE: As to the tenderness along the course of the vein, here is a case in which palpation of the vein might be dangerous. The clot extends down to the subclavian artery. I have always thought that a good deal of care should be taken for that reason. I have not seen a clot as low as this for a long time.

Further Report.—A condition developed that was diagnosed as bilateral pneumonia. Because of cyanosis, the patient was in an oxygen tent for five days before she died. At autopsy the left transverse sinus showed a pyemic membrane extending to the torcular crossing to the right transverse sinus as far as the knee. Both lungs were riddled with pyemic infarcts, practically solidifying the lung.

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOLARYNGOLOGY

H. P. SCHENCK, M.D., *Reporter*

Jan. 21, 1931

RALPH BUTLER, M.D., *Chairman*

ROENTGENOGRAPHIC ANATOMY AND PHYSIOLOGY OF THE LARYNX AND ADJACENT STRUCTURES. DR. HENRY K. PANCOAST.

The upper respiratory tract is becoming an important field for roentgenologic diagnosis. The essential factor is a careful study of the soft structures of the neck. Fluoroscopy and roentgenography are equally important in the examination. The former shows functional movements of the larynx and all adjacent structures and derangements of function, as well as defects in outline and encroachments on the lumen and displacements due to growths, paralyses and inflammatory conditions, while the latter records these observations and shows finer details.

For fluoroscopy, the eyes must be so well accommodated as to see the ventricle of the larynx and movements of the arytenoids. The normal ventricular air space is zeppelin-shaped. If seen intact and clearly, one can exclude a growth or inflammatory condition of the larynx and recurrent laryngeal paralysis. If not seen distinctly, one of these three groups of conditions must be present. The movement of the arytenoids must be studied with phonation of vowels and with swallowing. As these muscles have lateral and sagittal movements, they must be observed in various directions. The freedom of movement of the epiglottis and larynx as a whole must next be watched. Freedom of movement of the soft palate is best determined by having the patient whistle. The swallowing act should be studied next with a thin bismuth suspension. This shows the motor mechanism of the pharynx, larynx and upper end of the esophagus and the movability of the epiglottis, arytenoids and larynx; it outlines growths on the tongue and the epiglottis and in the pyriform sinuses and determines the patulousness of the food passages.

We have been able to observe and record the following sequence of events in the swallowing act: As the mouth fills and is filled, the tongue moves backward to close off the oropharynx and the nasopharynx. At the next step, several things happen simultaneously and quickly. The larynx rises so that the arytenoids come in contact with the undersurface of the epiglottis, which has been tilted slightly back by the tongue and held there; this closes off the larynx. The tongue pushes

the bolus into the pharynx or allows it to drop into the latter. The tongue then tightly closes off the oropharynx and the nasopharynx, and the pharynx contracts and forces the bolus into the esophagus. When all of the food has entered the latter and the pharynx and pyriform sinuses are empty, the larynx descends, the tongue goes forward, the epiglottis springs back into its vertical position, and all of the structures have returned to their normal positions.

Interference with the normal swallowing act in any way and with the movements of the arytenoids and the absence of the ventricular air space are observations which indicate a careful endoscopic examination, especially when the roentgenograms do not show the exact lesion present. In paralysis of the vocal cords, there may be a complete absence of the space; it may be a narrow half zeppelin shape, or the lower posterior portion may be obliterated. The mechanism of acquired speech following laryngectomy has been studied and recorded by fluoroscopic and roentgenographic study.

The normal soft tissue space between the pharynx, larynx and trachea and the cervical vertebral bodies has been carefully measured for different ages in each sex, and increased thickness is known to indicate growths, abscesses and foreign bodies in the upper end of the esophagus, as the case may be.

THE VALUE OF ROENTGEN DIAGNOSIS IN DISEASES OF THE NECK AND UPPER RESPIRATORY TRACT. DR. EUGENE P. PENDERGRASS. (Lantern slide demonstration.)

The fluoroscopic and roentgen study of the neck and upper respiratory tract is one of the most valuable supplementary examinations the laryngologists and bronchoscopists have at their disposal. Roentgen examination offers a permanent record of the location and extent of the disease or growth, just as the microscopic slide becomes a permanent record of the pathologic process. Any investigation of the upper respiratory tract should include a collective study of the pharynx, neck and chest. In infants and children this wide inclusion should be adopted as a routine procedure in every examination of the chest. Many suspected intrathoracic conditions may be explained in part, or entirely, by obstructive lesions high in the respiratory tract.

Our interests in, and realization of, the importance of the aid of the roentgen diagnosis in this particular region began with the study of a few cases of retrolaryngeal abscess. Appreciation of the diagnostic possibilities became a reality after studying the observations of Hay.

Foreign bodies in the upper respiratory tract are clearly visible when lodged in any of the air spaces, because, no matter what the nature or atomic weight, the intruder is surrounded by air and is easily visible. It may be necessary to use opaque solutions or substances to demonstrate nonopaque foreign bodies in the upper end of the esophagus. Nasopharyngeal growths and growths in the posterior nares are easily detected because of their encroachment on the relatively small space in the nasopharynx.

Lesions involving the soft palate cause either a swelling of this organ or a disturbance in innervation, or both. Carcinoma of the tongue, lingual thyroid and carcinoma of the vallecula, either with or without involvement of the epiglottis, cause a disturbance in the swallowing act and a deformation of these structures which can be easily detected.

In infections of the larynx, the roentgenologic evidence is absence of the ventricles. Fluoroscopically, one may note a disturbance in innervation and motility of the arytenoids. Acute diphtheria may cause a distinct encroachment on the lumen of the larynx and upper end of the trachea, due to the membrane. This particular disease usually involves the conus elasticus. Tuberculosis may cause an obliteration of the ventricles and a disturbance in the motility of the arytenoids. The motility of the arytenoids is particularly observed during the swallowing act.

Stenosis of the trachea may be due to infections or trauma, or they may be of congenital origin. The most frequent type of stenosis of the trachea is that found following diphtheria. The ventricle of the larynx is clearly visible in all normal persons during phonation and is zeppelin-shaped. It occupies the anterior three fifths of the larynx. Its presence is of distinct value in the diagnosis of infections, growths and recurrent paralysis. All of these conditions may cause an obliteration of the ventricle.

In growths, the ventricle may be encroached on or it may be entirely obliterated. Extensive growths may cause a disturbance of the upper end of the air spaces in the trachea. This disturbance may assume various formations, depending on the type of growth.

Retropharyngeal abscess causes a distinct decrease in the retropharyngeal space, and is easily demonstrated at the fluoroscopic and roentgenologic examination. It is important to remember that in children two phases of respiration are necessary in arriving at a definite diagnosis.

DISCUSSION

DR. WILLIS F. MANGES: This work represents the type of roentgenology that requires a roentgenologist. Some physicians do not care for a roentgenologic report, but merely request the films. In work of this kind so much depends on technic that even roentgenologists who have not studied such work as that done by Dr. Pancoast and Dr. Pendergrass will find themselves unable to make diagnoses. There is nothing to criticize. Commendation is all that is appropriate. In studying the larynx and adjacent structures, I have found it difficult to decide whether variations in the shadow represent normal variations or pathologic variations. As Dr. Pancoast and Dr. Pendergrass have shown, the anatomy may be strikingly brought out when the roentgenograms have been made under proper conditions. I agree with Dr. Pancoast's view of the mechanism of swallowing. I believe that the larynx does elevate and come into contact with the pushed down epiglottis and the larynx is in that fashion closed off. In regard to foreign bodies in the upper air passages, you as clinicians are interested. Frequently we find a foreign body that may have been there for a long time. In one case, a pencil eraser was found months later in the nose because a roentgenogram was taken after persistent epistaxis. In another case complete stenosis resulted after a dental plate had been in the larynx for seventeen years. Children have carried safety-pins in the lungs for months. In one case the patient was comfortable after tracheotomy had been performed, but when the tracheotomy tube could not be removed the child was sent to Dr. Chevalier Jackson, who found a pin and removed it; the pin had been in the trachea for nine months. An open safety-pin is apt to lodge in the upper air passages, and may penetrate portions of the larynx. Thumb tacks are apt to penetrate the pharyngeal wall. Fish bones may go almost to the junction of the pharynx and the esophagus. A diagnosis of non-opaque foreign bodies in the pharynx cannot be made unless swelling is produced. A fish bone or a splinter cannot be eliminated by roentgenograms. New growths and abscesses have been shown from the excellent collection of Dr. Pendergrass, and I can but express my admiration for the presentation.

DR. FIELDING O. LEWIS: I think that we are all much indebted to Dr. Pancoast and Dr. Pendergrass for this presentation. The roentgenologists are becoming indispensable as far as laryngologists are concerned. I do not think there is any doubt that the larynx is elevated as may be demonstrated in laryngotomy. There is astounding strength in the closure of the larynx. A finger introduced into the larynx in laryngectomy is caught in a contraction sufficiently great to be painful to the finger. In plates taken after laryngectomy I found much of interest. Previously, I thought that the buccal voice that developed was due to the swallowing of air which was later used, but here we have been shown conclusively that the air chamber is in the upper part of the esophagus and the

lower part of the larynx. I hope that Dr. Pancoast can show what acts as a pseudoglottis. The posterior pillars of the pharynx may be the pseudoglottis, as appeared to be the case in two of our patients on whom nasopharyngoscopy was performed. Sometimes the manner in which the tissues heal may leave structures that may serve as a pseudoglottis. In the diagnosis and treatment of malignant disease, such observations have been of great value. If they can tell us when the disease is limited, we have hopes of saving the lives of some of these patients by radical surgical intervention and roentgen treatment.

DR. GABRIEL TUCKER: The broncho-esophagists and roentgenologists have been closely linked together by Dr. Chevalier Jackson. Success in the bronchoscopic clinics depends on the efficiency of the roentgen department, and success in bronchoscopy depends on support from the roentgenologists.

Directory of Otolaryngologic Societies *

NATIONAL

American Medical Association, Section on Laryngology, Otology and Rhinology

Chairman: Dr. T. E. Carmody, 227, 16th St., Denver.
Secretary: Dr. Gabriel Tucker, Bronchoscopic Clinic, University Hospital, Philadelphia.
Place: Philadelphia. Time: June 8-12, 1931.

American Academy of Ophthalmology and Oto-Laryngology

President: Dr. J. F. Barnhill, Miami Beach, Fla.
President-Elect: S. Hanford McKee, 1528 Crescent St., Montreal, Canada.
Executive Secretary: Dr. William P. Wherry, Medical Arts Bldg., Omaha.
Place: French Lick, Ind. Time: Sept. 14-19, 1931.

American Bronchoscopic Society

President: Dr, Henry B. Orton, 24 Commerce St., Newark, N. J.
Secretary-Treasurer: Dr. Louis H. Clerf, 128 S. 10th St., Philadelphia.
Place: St. Louis. Time: June 6, 1931.

American Laryngological Association

President: Dr. Francis R. Packard, 304 S. 19th St., Philadelphia.
Secretary: Dr. George M. Coates, 1721 Pine St., Philadelphia.
Place: Atlantic City, N. J. Time: June 15-17, 1931.

American Laryngological, Rhinological and Otological Society

President: Dr. Max A. Goldstein, 3858 Westminster Pl., St. Louis.
Secretary: Dr. R. L. Loughran, 33 E. 63d St., New York.
Place: St. Louis. Time: June 3-5, 1931.

American Otological Society

President: Dr. David H. Walker, 101 Bay State Rd., Boston.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.
Place: Briarcliff, N. Y. Time: June 17-19, 1931.

SECTIONAL

Eastern New York Eye, Ear, Nose and Throat Association

President: Dr. G. G. Marshall, 122 West St., Rutland, Vt.
Secretary-Treasurer: Dr. Arthur F. Holding, 142 Washington Ave., Albany.
Time: Third Wednesday of October, November, March, April, May and June.

New England Otological and Laryngological Society

President: Dr. Harry P. Cahill, 520 Commonwealth Ave., Boston.
Secretary-Treasurer: Dr. Lyman G. Richards, 319 Longwood Ave., Boston.

Pacific Coast Oto-Ophthalmological Society

President: Dr. Chester H. Bowers, 1136 W. 6th St., Los Angeles.
Secretary-Treasurer: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. Albert E. Hillis, 1115 Pacific Ave., Tacoma, Wash.
Secretary-Treasurer: Dr. Francis A. Brugman, 806 Cobb Bldg., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

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* Secretaries of societies are requested to furnished the information necessary to make this list complete and to keep it up to date.

Sioux Valley Eye and Ear Academy

President: Dr. Claude T. Uren, City National Bank Bldg., Omaha.
Secretary-Treasurer: Dr. Frederick H. Roost, 420 Trimble Bldg., Sioux City, Iowa.
Place: Fontanelle Hotel, Omaha. Time: November, 1931.

Southern Medical Association, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Fletcher D. Woodward, Box 162, University, Va.
Secretary: Dr. W. D. Gill, 323 Medical Arts Bldg., San Antonio, Texas.
Place: New Orleans. Time: November, 1931.

Southwestern Michigan Triological Society

President: Dr. Wilfrid Haughey, 65 W. Michigan Ave., Battle Creek.
Secretary: Dr. R. H. Fraser, Battle Creek Sanitarium, Battle Creek.
Time: Third Thursday of alternate months.

STATE

Colorado Oto-Laryngological Society

President: Dr. C. E. Cooper, 227, 16th St., Denver.
Secretary: Dr. Rex L. Murphy, Metropolitan Bldg., Denver.
Place: Assembly Room of Metropolitan Bldg. Time: First Saturday of each month from October to May.

Connecticut State Medical Society, Section on Eye, Ear, Nose and Throat

President: Dr. Dorland Smith, 836 Myrtle Ave., Bridgeport.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.

Eye, Ear, Nose and Throat Club of Georgia

President: Dr. William L. McDougall, 50 Whitehall St., S. W., Atlanta.
Secretary-Treasurer: Dr. William O. Martin, Jr., 412 Medical Arts Bldg., Atlanta.

Indiana Academy of Ophthalmology and Oto-Laryngology

President: Dr. John W. Carmack, 23 E. Ohio St., Indianapolis.
Secretary: Dr. J. Kent Leasure, 23 E. Ohio St., Indianapolis.

Iowa Academy of Ophthalmology and Oto-Laryngology

President: Dr. Gordon F. Harkness, 215 Main St., Davenport.
Secretary-Treasurer: Dr. W. F. Boiler, 105 East Iowa Ave., Iowa City.

Minnesota Academy of Ophthalmology and Oto-Laryngology

President: Dr. John C. Brown, 350 St. Peter St., St. Paul.
Secretary-Treasurer: Dr. Hendrie W. Grant, Lowry Bldg., St. Paul.

Montana Academy of Oto-Ophthalmology

President: Dr. L. H. Huber, Livingston.
Secretary: Dr. A. W. Morse, Phoenix Bldg., Butte.
Time: Semi-annually.

North Dakota Academy of Ophthalmology and Otolaryngology

President: Dr. H. B. Beeson, 232 W. De Mers Ave., Grand Forks.
Secretary-Treasurer: Dr. F. L. Wicks, Valley City.

Oregon Academy of Ophthalmology and Otolaryngology

President: Dr. J. W. McCollom, 346½ Washington St., Portland, Ore.
Secretary: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland, Ore.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

Rhode Island Ophthalmological and Otological Society

President: Dr. Raymond F. Hacking, 105 Waterman St., Providence.
Secretary: Dr. Herman A. Winkler, 224 Thayer St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

Utah Ophthalmological Society

President: Dr. F. M. McHugh, 17 Exchange Pl., Salt Lake City.
Secretary-Treasurer: Dr. W. Leroy Smith, Erza Thompson Bldg., Salt Lake City.

Virginia Society of Otolaryngology and Ophthalmology

President: Dr. Fletcher D. Woodward, Box 162, University.
Secretary-Treasurer: Dr. Henry Grant Preston, Harrisonburg.

West Virginia State Medical Association, Eye, Ear, Nose and Throat Section

President: Dr. S. S. Hall, Fairmont.
Secretary: Dr. G. A. Smith, Montgomery.

LOCAL

Academy of Medicine of Northern New Jersey, Section on Eye, Ear, Nose and Throat

Chairman: Dr. J. Wallace Hurff, 86 Washington St., Newark.
Secretary: Dr. Earl LeRoy Wood, 31 Lincoln Park, Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

Atlanta Academy of Ophthalmology and Otolaryngology

President: Dr. John R. Childs, 45 Edgewood Ave., Atlanta.
Secretary: Dr. William O. Martin, Jr., 384 Peachtree St., Atlanta.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

Baltimore City Medical Society, Section on Otology and Laryngology

Chairman: Dr. William R. McKenzie, 11 E. Chase St., Baltimore.
Secretary: Dr. James J. Chisolm, Medical Arts Bldg., Baltimore.
Place: 1211 Cathedral St. Time: 8:30 p. m., last Friday of each month.

Chicago Laryngological and Otological Society

President: Dr. George J. Dennis, 25 E. Washnigton St., Chicago.
Secretary-Treasurer: Dr. Austin A. Hayden, 25 E. Washington St., Chicago.
Place: Medical and Dental Arts Bldg., 185 N. Wabash Ave. Time: 6 p. m., first Monday of each month from October to May.

Cincinnati Oto-Laryngological Society

President: Dr. Edward D. King, 707 Race St., Cincinnati.
President-Elect: Dr. M. F. McCarthy, Union Central Bldg., Cincinnati.
Secretary-Treasurer: Dr. Samuel Seltz, Provident Bank Bldg., Cincinnati.
Place: University Club. Time: 6:45 p. m., second Tuesday of each month from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Otolaryngology

Chairman: Dr. William V. Mullin, 9204 Euclid Ave., Cleveland.
Secretary: Dr. H. C. Rosenberger, 2064 E. 9th St., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOLARYNGOLOGY

Chairman: Dr. Ralph Butler, 2007 Chestnut St., Philadelphia.
Clerk: Dr. Karl M. Houser, 1826 Pine St., Philadelphia.
Place: College of Physicians. Time: 8:30 p. m., third Wednesday of each month from October to June.

COLUMBUS OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY

Chairman: Dr. A. M. Hauer, 327 E. State St., Columbus, Ohio.
Secretary-Treasurer: Dr. Albert D. Frost, 681 E. Broad St., Columbus, Ohio.
Time: First Monday of each month.

DALLAS ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. H. B. Decherd, 1717 Pacific Ave., Dallas, Texas.
Secretary: Dr. W. Mood Knowles, 1717 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

DETROIT OTO-LARYNGOLOGICAL SOCIETY

President: Dr. Don A. Cohoe, 13535 Woodward Ave., Detroit.
Secretary-Treasurer: Dr. R. Lee Laird, 513 David Whitney Bldg., Detroit.
Place: Maccabees Bldg. Time: Third Wednesday evening of each month from October to May.

FORT WORTH EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. J. J. Richardson, 606 Penn St., Fort Worth, Texas.
Secretary-Treasurer: Dr. R. H. Needham, 1304 Medical Arts Bldg., Fort Worth, Texas.
Place: University Club. Time: 6:30 p. m., first Friday of each month except July and August.

HOUSTON ACADEMY OF MEDICINE, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. Claude C. Cody, 1306 Walker Ave., Houston, Texas.
Secretary: Dr. J. M. Robinson, Eye, Ear, Nose and Throat Hospital, Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., first Thursday of each month from September to June.

INDIANAPOLIS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. E. L. Lingeman, 241 N. Pennsylvania St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, Hume-Mansur Bldg., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

KANSAS CITY SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. A. E. Eubank, Arygle Bldg., Kansas City, Mo.
Secretary: Dr. O. S. Gilliland, Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

LONG BEACH EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. Dean E. Godwin, Security Bldg., Long Beach, Calif.
Secretary-Treasurer: Dr. Ferris Arnold, Security Bldg., Long Beach, Calif.
Place: Pacific Coast Club. Time: Last Wednesday of each month from September to June.

LOS ANGELES COUNTY MEDICAL SOCIETY, SECTION OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Eugene R. Lewis, 727 W. 7th St., Los Angeles.
Secretary-Treasurer: Dr. J. Frank Friesen, 727 W. 7th St., Los Angeles.
Place: California Hospital, assembly room. Time: 8 p. m., first Monday of of each month, May to November, inclusive.

Medical Society of the County of Kings, Section on Otolaryngology

Chairman: Dr. John M. Auwerda, 878 President St., Brooklyn.
Secretary-Treasurer: Dr. Charles R. Weeth, 37 Remsen St., Brooklyn.
Place: Library Bldg., County Society, 1313 Bedford St., Brooklyn.
Time: 9 p. m., second Wednesday of January, March, May and November.

Medical Society of the District of Columbia, Section on Ophthalmology and Oto-Laryngology

Chairman: Dr. James A. Flynn, 1511 Rhode Island Ave., Washington.
Secretary: Dr. E. R. Gookin, Medical Science Bldg., Washington.
Place: 1718 M St., N. W.: Time: 8 p. m., third Friday of each month.

Memphis Society of Ophthalmology and Oto-Laryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

The Milwaukee Oto-Ophthalmic Society

President: Edward R. Ryan, 425 E. Water St., Milwaukee.
Secretary-Treasurer: Dr. O. P. Schoofs, 120 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. Hilliard Wood, 700 Church St., Nashville.
Secretary-Treasurer: H. C. Smith, Medical Arts Bldg., Nashville.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month.

New Orleans Ophthalmological and Otological Society

President: Dr. W. R. Buffington, 211 Camp St., New Orleans.
Secretary-Treasurer: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: January to June and October to January—third Thursday of each month.

New York Academy of Medicine, Section of Laryngology and Rhinology

Chairman: Dr. John M. Loré, 240 West End Ave., New York.
Secretary: Dr. Robert E. Buckley, 2 E. 103d St., New York.
Place: 103d St., and 5th Ave. Time: 8:30 p. m., fourth Wednesday of each month from October to May.

New York Academy of Medicine, Section of Otology

Chairman: Dr. Clarence H. Smith, 2 E. 54th St., New York.
Secretary: Dr. James Garfield Dwyer, 57 W. 57th St., New York.
Place: 103d St. and 5th Ave. Time: Second Friday of each month from October to May.

Omaha and Council Bluffs Ophthalmological and Otolaryngological Society

President: Dr. Charles M. Swab, Medical Arts Bldg., Omaha.
Secretary-Treasurer: Dr. J. C. Davis, 1615 Howard St., Omaha.
Place: Medical Arts Tea Room. Time: 5:15 and 7 p. m., third Wednesday of each month from October to May.

Philadelphia Laryngological Society

President: Dr. Arthur J. Wagers, 1429 Spruce St., Philadelphia.
Secretary: Dr. Herman B. Cohen, 1301 Spruce St., Philadelphia.
Place: College of Physicians. Time: 8:30 p. m., first Tuesday of each month from October to June.

Pittsburgh Otological Society

Chairman: Dr. James Homer McCready, 121 University Place, Pittsburgh.
Secretary-Treasurer: Dr. Roy C. Cooper, 510 S. Aiken Ave., Pittsburgh.

Richmond Ophthalmological and Oto-Laryngological Society

President: Dr. Emanuel U. Wallerstein, Professional Bldg., Richmond, Va.
Secretary: Dr. William R. Weisiger, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

Chairman: Dr. Clyde Heatly, 11 N. Goodman St., Rochester, N. Y.
Secretary-Treasurer: Dr. John F. Gipner, 53 S. Fitzhugh St., Rochester, N. Y.
Place: Rochester Medical Association, 13 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ear, Nose and Throat Club

Acting President: Senior member of the executive committee: Dr. George E. Hourn, 607 N. Grand Blvd., St. Louis.
Secretary: Dr. Arthur M. Alden, Frisco Bldg., St. Louis.
Place: University Club Bldg. Time: Third Wednesday in February, April, October and December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. T. J. Walthall, 728 Main St., San Antonio, Texas.
Secretary-Treasurer: Dr. E. D. Dumas, 425 Medical Arts Bldg., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Wilber F. Swett, 693 Sutter St., San Francisco.
Secretary: Dr. Robert Carson Martin, 384 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco. Time: Third Tuesday of every month except May, June, July and December.

Spokane Academy of Ophthalmology and Otolaryngology

President: Dr. Paul A. Remington, Old National Bank Bldg., Spokane, Wash.
Secretary: Dr. Louis A. Parsell, Paulsen Medical and Dental Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. Searle B. Marlow, State Tower Bldg., Syracuse, N. Y.
Secretary-Treasurer: Dr. A. Harry Rubinstein, Medical Arts Bldg., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.

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Manuscripts for publication, books for review, and correspondence relating to the editorial management should be sent to Dr. George E. Shambaugh, Editor-in-Chief, 122 South Michigan Avenue, Chicago, or to any other member of the Editorial board. Communications regarding subscriptions, reprints, etc., should be addressed, ARCHIVES OF OTOLARYNGOLOGY, American Medical Association, 535 North Dearborn Street, Chicago.

Articles are accepted for publication on condition that they are contributed solely to the ARCHIVES OF OTOLARYNGOLOGY. Manuscripts must be typewritten, preferably double spaced, and the original copy should be submitted. Zinc etchings and halftones of illustrations will be supplied by the publisher when the original illustrations warrant.

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